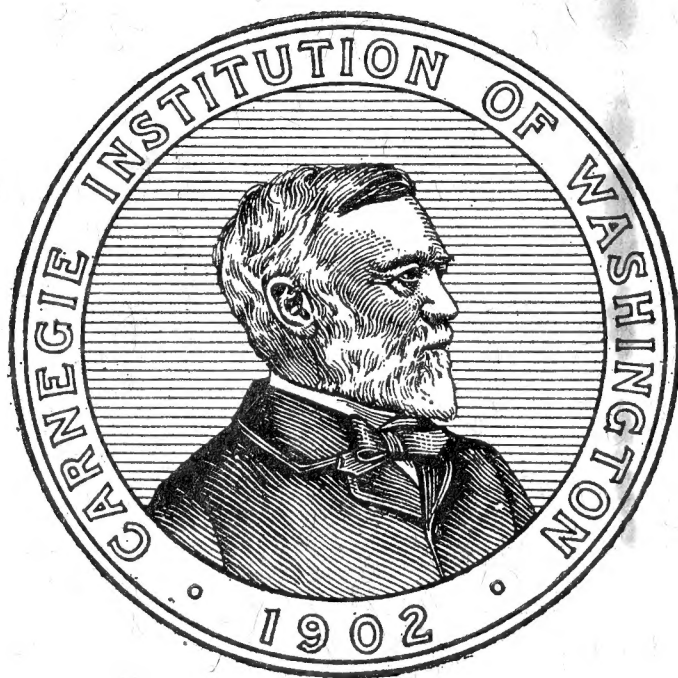


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# THE GENUS YOUNGIA

BY  
ERNEST B. BABCOCK  
AND  
G. LEDYARD STEBBINS, JR.



PUBLISHED BY CARNEGIE INSTITUTION OF WASHINGTON  
WASHINGTON, D.C.

1937



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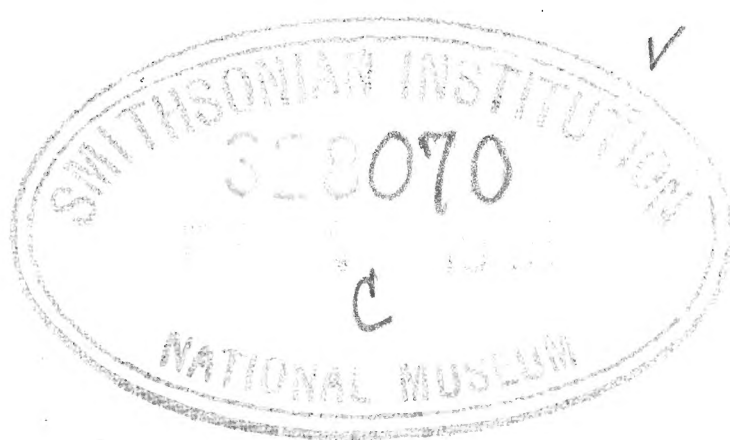


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# THE GENUS YOUNGIA

## INTRODUCTION

The extensive taxonomic and cytogenetic studies of the senior author on the genus *Crepis* have brought him frequently into contact with a group of Asiatic species which are included within this genus by most modern botanists, but which in many ways do not appear to be closely related to the bulk of the species of *Crepis*. This group, of which the widespread tropical weed usually designated *C. japonica* (L.) Benth. is the best-known representative, has by various authors since the time of Cassini been segregated as the genus *Youngia*, but in no treatment of it has this genus been founded on characters which do not occur in typical species of *Crepis*. A reexamination of it has, however, disclosed a number of distinguishing characteristics which have been overlooked by previous workers, and which, in our opinion, justify the reestablishment of the genus *Youngia*. In addition, cytological studies of such species as have been available have disclosed a striking difference in both the number and the morphology of the chromosomes of this group from that found in *Crepis* species, and a relative homogeneity within the group. With these facts in mind, a monographic treatment of the species has been undertaken, with the object of redefining the genus and its relationships to *Crepis* and the neighboring genera, and of clarifying the interrelationships of the species. Unfortunately, the latter object can be attained with only partial success, owing to the remoteness of the localities at which many of the species, particularly the more primitive ones, occur, and the consequent scarcity of herbarium material of them. It is to be hoped that future exploration in western and southwestern China will amplify our knowledge concerning these species, and that the present monograph will serve as a helpful guide to students of the flora of this most interesting region, and the bit of its flora represented by the species discussed here.

## HISTORY OF THE GENUS

*Youngia* was first described by H. Cassini in 1831 on the basis of two species, *Y. lyrata* Cass. and *Y. integrifolia* Cass., both of which are synonymous with *Prenanthes japonica* L. Although the authors have not seen the types of Linnæus and Cassini, the original descriptions are sufficiently complete and precise to

warrant acceptance of the Linnæan specific name, which was authenticated by De Candolle in 1838, Bentham in 1861, and Hooker in 1882, and was verified in *Index Kewensis*. Cassini believed that *Youngia* could not be confounded with either *Crepis* or *Prenanthes* because of the characteristically compressed achenes. But he failed to call attention to an equally important feature, viz., the unequal ribs on the achenes. Thus the way was left open for the classification in *Youngia* of various species of *Crepis*, *Prenanthes*, *Lactuca*, and other genera. In some of these instances it appears that reference to *Youngia* was based mainly on superficial resemblance of the involucre, since the achenes are not only equally ribbed but also mostly terete.

The genus was maintained by De Candolle (Prod. 7:192-194, 1838) and based on the small, few-flowered, cylindric heads, the calyculate involucre, and the achenes, characterized as "oblonga, nunc compressa, nunc sæpe in eiusdem capitulis subtrigona, longitudinaliter striata, erostria utrinque subattenuata." Although he listed eighteen specific names, ten of these are synonymous with the polymorphic type species. Of the other eight, all included as "Species non satis notæ," two, *Y. procumbens* and *Y. acaulis*, are species of *Launæa*; one, *Y. humilis*, is in *Lapsana*; and the other five, *Y. lanceolata*, *Y. dentata*, *Y. debilis*, *Y. chinensis*, and *Y. hastata*, have been placed by recent authors either in *Lactuca* (Bentham and Hooker, Makino) or *Ixeris* and related genera (Gray, Nakai, and the present writers; cf. p. 105 for synonymy).

Wight (Ic. Plant. Ind. Or. 3(4):13, pl. 1147, 1844-1849), although retaining the generic name, suggested that the genus be referred to De Candolle's *Brachyrampus*, which was maintained by Bentham and Hooker (Gen. Pl. 2(1):524, 1873) as a section of *Lactuca*, and by Hoffmann (Pflanzenfamilien 4(5):370, 1891) as a section of *Launæa*. Up to this time, therefore, no author had considered the uniting of *Youngia* with *Crepis*.

Endlicher (Gen., Suppt. 1:1338, 1840), Meisner (Gen. 237, 1836-1843), Ledebour (Flor. Ross. 2:837, 1844-1846), and most other authors between 1838 and 1859 followed more or less exactly the description and treatment of De Candolle. Ledebour transferred to the genus two species, *Prenanthes diversifolia* Ledeb. (= *Crepis tenuifolia* Willd.) and *Crepis stenoma* Turcz.

Gray, in 1859 (Mem. Am. Acad. Sci. n.s. 6:396), mentioned the genus in a brief note accompanying his description of a collection of plants from Japan. He remarked that "the pubescent tube of the corolla, the uniserial pappus, and the habit, may keep this genus distinct from *Crepis*," but made no reference to the



distinguishing characteristics emphasized by Cassini and De Candolle.

In 1861, Bentham (*Flora Hongkongensis* 194) reduced the genus to *Crepis*, observing that "the characters by which A. Gray thinks the genus *Youngia* might still be kept distinct from *Crepis* occur nevertheless in the typical European *C. virens*" (= *C. capillaris* (L.) Wallr.). With this opinion of Gray's diagnosis the present authors agree, but apparently neither Gray nor Bentham at that time judged the validity of the genus on the basis of the characters originally proposed by Cassini, and repeated by De Candolle.

Bentham and Hooker (*Gen. Pl.* 2(1):514, 1873) subsequently recognized *Youngia* as a section of *Crepis*, using as its distinguishing characteristics only the habit and the smaller, narrower involucre with the bracts less thickened at maturity. Of the achenes, they said (*op. cit.*, 515), "Achænia in *Youngia* perperam a Candolleo compressa dicuntur, matura semper subteretia  $\infty$  costata invenimus." They suggested that, on account of its flattened achenes, *Y. stenoma* (Turcz.) Ledeb. should be referred to *Sonchus*, although that species in all other characteristics is as different from true *Sonchus* as any other species of *Youngia* or *Crepis*. So far as the present writers can determine, Bentham's opinion of the achenes of *Youngia* as subterete was not shared by any other contemporary student of Asiatic Compositæ.

Maximowicz, who was as familiar in the field with *Youngia* and its close relatives as any botanist of his time, gave the following opinion of Bentham's reduction of *Y. japonica* to *Crepis* (*Bull. Acad. Sci. St. Petersburg* 19:521, 1874): "Achæmium perfecte maturum est subcompressum, ita ut de *Y. fuscipappa* sua refert Thwaites. Differentia igitur ab achænio tereti in *Crepide*, et pl. m. compressa in *Lactuca* a Benthamio petita, in natura evanescit, nam in *Ixeridibus* nonnullis (a Benthamio *Lactucæ* adnumeratis) achænia non magis compressa quam v. gr. in *Cr. japonica* et discrimen unicum utriusque generis quærendum est in habitu, haud semper distincto." With this opinion, and a similar one expressed by Nakai (*Bot. Mag. Tokyo* 24:158, 1920), that the retaining of *Youngia* in *Crepis* and *Ixeris* in *Lactuca* obliterates the distinction between these two genera, the present writers are in perfect agreement.

C. B. Clarke (*Comp. Ind.* 253, 1876), one of the most observant of the earlier students of oriental Compositæ, included in his description of *C. lyrata* (= *Y. japonica*) the remark, "achæmium, in exemplis bene evolutis, distincte compressum," and, since he made no reference to the generic descriptions of Cassini or De Candolle, was apparently recording his own observa-

tion of this fact. He concluded, consequently, that “subgenus *Youngia* (mihi) cum *Lactuca* melius quam cum *Crepide* associare potest.” Hooker (Fl. Brit. Ind. 3:395, 1882) referred to the remarks of Wight and Clarke with the comment: “The fact is it will go with either *Crepis* or *Lactuca*, but has rather the habit of the former, according to Bentham’s and my view of the limitation of these very artificial genera.” Since Bentham and Hooker included within *Lactuca* the five species of *Ixeris* and related genera which, in addition to *Y. japonica* and its synonyms, De Candolle placed, largely on the basis of their habit, in *Youngia*, and which, in the opinion of the present writers as well, *Y. japonica* resembles in habit more closely than any typical species of *Crepis*, this remark is rather surprising.

Hoffmann (Pflanzenfam. 4(5):374, 1891) and Hooker and Jackson (Index Kewensis 4:1243, 1895) maintained the treatment of Bentham and Hooker without further comment. Rydberg (Rocky Mt. Flora 1021, 1917) revived the genus *Youngia* for *C. elegans* Hook. and *C. nana* Richards., using as the key character to distinguish the genus from *Crepis* “pappus bristles promptly deciduous.” Since, in spite of Hoffmann’s (*loc. cit.*) characterization of the pappus of *Crepis* sect. *Youngia* as “leicht abfallend,” this is true to only a very limited extent of the type species, *Y. japonica*, and since *C. elegans* and *C. nana* are in their achenes and every other characteristic except their involucre typical of *Crepis* rather than of *Youngia*, Rydberg’s disposition of these species cannot be followed by the present writers.

To summarize, the only workers before 1890 who believed that *Youngia* should be united with *Crepis* were Bentham and Hooker, the former basing his opinion on the mistaken diagnosis of Gray and his erroneous conception of the achenes of *Y. japonica*, the latter on a supposed resemblance in habit between the two genera. Since 1890 the opinion of these authors on the typical Asiatic species of *Youngia* has apparently been accepted universally without question.

## DIAGNOSES OF THE GENUS

### ORIGINAL DESCRIPTION

Since the original description of Cassini, first published in *Annales des Sciences Naturelles*, series I, 23:88, 1831, and, somewhat abbreviated, in *Opusculæ Phytologiques*, 3:86, 1834, is not generally accessible, the diagnosis is reproduced below:

“*YOUNGIA*, H. Cass. Calathide incouronnée, radiatiforme, multiflore, fissiflore, androgyniflore. Péricline inférieur aux fleurs, formé de huit squames unisériées, entrecroisées à la base, se recouvrant par les bords, égales, appliquées, oblongues-lancéolées, foliacées, membraneuses sur les bords, munies d’une nervure médiane, qui devient, vers la base,



large, épaisse, subéreuse; la base du péricline entourée d'environ cinq squamules surnuméraires, irrégulièrement disposées, submisériées, courtes, ovales. Anticlinanthe revêtu d'une lame épaisse, ou couche subéreuse, formée par la confluence des nervures des squames. Clinanthe plan, absolument nu. Fruits oblongs, plus ou moins aplatis, souvent un peu anguleux, striés longitudinalement, hispidules vers le sommet, absolument privés de col; aigrette longue, blanche, composée de squamellules nombreuses, filiformes, très-fines, à peine barbellulées. Corolles garnies de longs poils fins et frisés autour de la partie supérieure du tube."

Then follows the description of two species. The first, *Y. lyrata* H. Cass., is synonymous with *Y. japonica* (L.) DC., which thus becomes the type species of the genus. The second, *Y. integrifolia* H. Cass., is not described at length. The author merely states as follows:

"Cette plante, qui n'est peut-être qu'une variété de la précédente, paraît en différer spécifiquement, en ce qu'elle est beaucoup plus petite, et que ses feuilles, au lieu d'être lyrées, ont un long pétiole grêle, nu, terminé par un limbe elliptique, plus ou moins sinué sur les bords."

Cassini states that the genus commemorates the name of two English celebrities, one a poet, the other a physician. He then discusses the relationship of *Youngia* to certain other genera.

#### AMPLIFIED DIAGNOSIS

*Youngia* Cassini. Plant herbaceous, annual, biennial, or perennial; leaves mostly oblanceolate, lyrate- or runcinate-pinnatifid, pinnately compound, or entire and dentate or denticulate, glabrous or pubescent with fine or coarse many-celled trichomes, trichomes piliform, often crinkled, sometimes compressed and broader near base especially along midrib beneath; stem elongate or very short in the tufted species, glabrous, puberulent, or with a pubescence like that of the leaves, sometimes tomentose, often fistulose; aggregate inflorescence paniculate, cymose, or corymbiform; heads small or medium, 5- to 30-flowered, mostly about 15-flowered; involucre cylindric, dark green, usually glabrous (pubescent with piliform trichomes in *Y. tenuifolia*, gland-pubescent in *Y. cineripappa*, setaceous in *Y. depressa*), outer involucral bracts few, very short or rarely up to  $\frac{1}{3}$  or  $\frac{1}{2}$  (in *Y. parva* sometimes  $\frac{2}{3}$ ) as long as inner bracts; inner bracts 6 to 12, usually 8, lanceolate, mediodorsally nerved, in some species crested near the tip, becoming carinate and spongy-thickened near the base in fruit; receptacle naked; flowers yellow, ligule sometimes reddish on its outer face; anthers commonly green; style and style-branches usually yellow; achenes small, mostly less than 5 mm long, rarely longer, the marginal dorsoventrally compressed, all unequally ribbed, with 3 to 5 stronger ribs,  $\pm$  spiculate; pappus white, yellow, fuscous, or cinereous, usually persistent.

Eastern Asia from southern Siberia and Japan throughout China into Turkestan and the Himalaya region; one species in Ceylon; one in the Malay Archipelago.

Type species *Youngia japonica* (L.) DC. = *Y. lyrata* Cass. in Herb. DC.!

## CRITERIA OF CLASSIFICATION

The criteria of classification which have been found most significant and dependable in this genus are discussed below in order of importance.

1. *Habit*. The form of the plant as determined by the presence or absence of an elongate stem bearing the aggregate inflorescence is the chief distinction under consideration. The section *Desiphylum* is delimited from all the other sections by the absence of such a stem. Except in one species, the plants are tufted and the flower heads are borne on short, one- to two-headed stems arising from the crown of the caudex. Occasionally these slender peduncles or two-headed stems bear the flower-heads somewhat above the low, tufted leaves, but there is never an obvious, elongate stem as in all the other sections. In the exceptional species *Y. conjunctiva*, the stem may reach a height of 10 cm, but some of the heads are borne on basal branches or secondary stems. The tufted species are all alpine plants, occurring at elevations from 3000 to 5000 meters. That the tufted habit is not a mere growth form but a genetic character has been demonstrated in the case of *Crepis nana typica*, a species of similar habit. Seeds of *C. nana* collected in Alaska produced plants which, although grown in a greenhouse at Berkeley, developed the typical tufted habit. In the sections other than *Desiphylum* striking differences in habit of the plant and character of the aggregate inflorescence are sometimes useful in separating groups of species.

2. *Pappus*. The color of the pappus is a dependable criterion for separation of the sections into two groups. In the section *Hieraciella* and in some species of sections *Mesomeris* and *Desiphylum*, the pappus is definitely pigmented, whereas in all the other sections it is white or only faintly tinged with yellow. The structure of the pappus is of great importance as a taxonomic character, since from the time of Cassini it has proved one of the fundamental characters for the separation of tribes and genera of the Cichorieæ. The best characterization of this structure was given by Lund (Bot. Tidsskr. ser. 2, II:121–182, 1872). Although the present authors do not agree with Lund that the pappus is simply a transformed calyx, they believe with him that at least the coarser types of pappus are foliar or sepaloid in their histological structure, and that the finer types are derived from the coarser by a process of reduction.

This hypothesis agrees better with the phylogenetic evidence from other sources throughout the genera of the Cichorieæ studied than does the alternative one maintained by Small (The Origin and Development of the Compositæ 106–111, 1916), that the



fine, capillary type of pappus is primitive, and that the coarser types are derived by the fusion of bristles. We therefore can accept Lund's grouping of the bristly pappus into three classes (*op. cit.*, 157-160). The pappus of *Youngia* falls into Lund's class B, in which the endophyll is moderately developed, and at least some bristles possess terminal hairs or trichomes. This was determined by examination of histological preparations available of both transverse and longitudinal sections of the buds of *Y. tenuifolia*, in which Lund's observations and drawings of this type of pappus were fully verified (cf. in particular his fig. 32, p. 146). Since the upper end of the endophyll tissue in the great majority of the bristles of *Y. tenuifolia* coincides within the length of one or two cells with the point at which the number of cells in the cross-section of a bristle is reduced from more than four cells to four or less, i.e., above which *the bristle consists of only four (or fewer) parallel rows of cells* (except at a few points where the barbs or the tapering end walls overlap), a criterion was established by which the extent of the endophyll tissue could be roughly determined by examination of the pappus of herbarium specimens. The pappus was removed from mature florets in water on a microscopic slide, then boiled for a minute or so, to remove the air bubbles from the interior of the cells. It was then observed under the high-power objective of a compound microscope at a magnification of 200 to 400 diameters, and the point was determined for several bristles, including the strongest and the weakest ones, above which the bristle consisted of only four or fewer parallel rows of cells (which number could be easily determined by the use of the fine adjustment screw). The position of this point on the bristle determines the relative length of the phyllomatous part and the terminal trichome of the bristle, and it is on the basis of these determinations that the length of these trichomes is given in subsequent descriptions.<sup>1</sup>

Although there is a complete series of transition from the strongest to the weakest type of pappus found in *Youngia*, two general groups may be recognized. In the first, represented by the sections *Desiphylum* and *Stenophytum*, at least some of the bristles (except in one species) lack terminal trichomes, and the trichome is never more than one-fourth the length of the bristle. In the second, represented by the remainder of the genus, all of the bristles possess trichomes, and in the weakest bristles these are about one-half the entire length of the bristle.

<sup>1</sup> It must be noted that this method is accurate only for the bristly pappus of such genera as *Crepis* and *Youngia*, in which "lateral hairs," many cells in thickness (cf. Lund, *op. cit.*, 145, 147), are not developed or only slightly developed.

The bristles are often united at the base and are usually persistent. The number and arrangement of the bristles vary rather definitely between species. As a rule there are clearly either one or two series, with more numerous bristles when there are two series. Differences in this respect occur in each section.

3. *Flower-heads*. The *Euyoungia* section is rather definitely set apart from the other five by its smaller heads. In only two species does the size overlap the lower extreme for the other sections, and these species are easily separated on other characters. Along with smaller heads in this section go smaller florets, smaller achenes, and shorter pappus; and the outer involucral bracts are consistently small. In respect to the last-mentioned feature the other sections are more variable, and in some sections the differences between species in this respect are striking. Thus in heads, flowers, and fruits there is a much stronger tendency to reduction in *Euyoungia* than in any other section. In number of florets per head, however, there is no consistent difference between the sections, except in the case of *Hieraciella*, which is monotypic, the species having only five florets per head. The general tendency within the genus is to have few florets per head, the largest number found being thirty. Presence or absence of a crest (a claw or small wing) on the involucral bracts is a useful feature in distinguishing certain species. The number of outer or inner involucral bracts is sometimes useful in distinguishing between species.

4. *Leaf shape*. In the four species which we have cultivated, the leaves maintain their characteristic form very faithfully. This has also been observed in many species of *Crepis*. Outstanding differences in form and character of dissection, therefore, serve as useful criteria in distinguishing certain sections and some of the species.

5. *Achenes*. As already mentioned, the structure of the achenes is the most important characteristic by which the genus *Youngia* may be distinguished from its relatives. As a general rule, at least the outer achenes are consistently flattened, although there is some difference between species in this respect. In contrast to most species of *Lactuca* and *Sonchus*, however, the outer achenes of a head are always more flattened than the inner, and the latter in particular do not possess the two strong lateral ribs characteristic of the achenes of *Lactuca*. The contrast between *Youngia* and *Crepis* is just as great, since in the latter such compression of the achenes as exists is as likely to be lateral as it is to be dorsoventral, and the ribs are essentially equal (fig. 1, *l-o*). In *Ixeris* the achenes are similar in shape to those of *Youngia* but the ribs are very nearly equal (fig. 1, *p-s*).

In *Youngia* the ribs of the achenes are in most species arranged as follows: Five ribs are stronger than the rest. Of these, two run along the sides of the achene, one down the middle of the ventral (inner) surface, and two, less distinct, about equally spaced on the convex dorsal (outer) surface (fig. 1, *a-d*). The intervening, secondary ribs number five to ten and

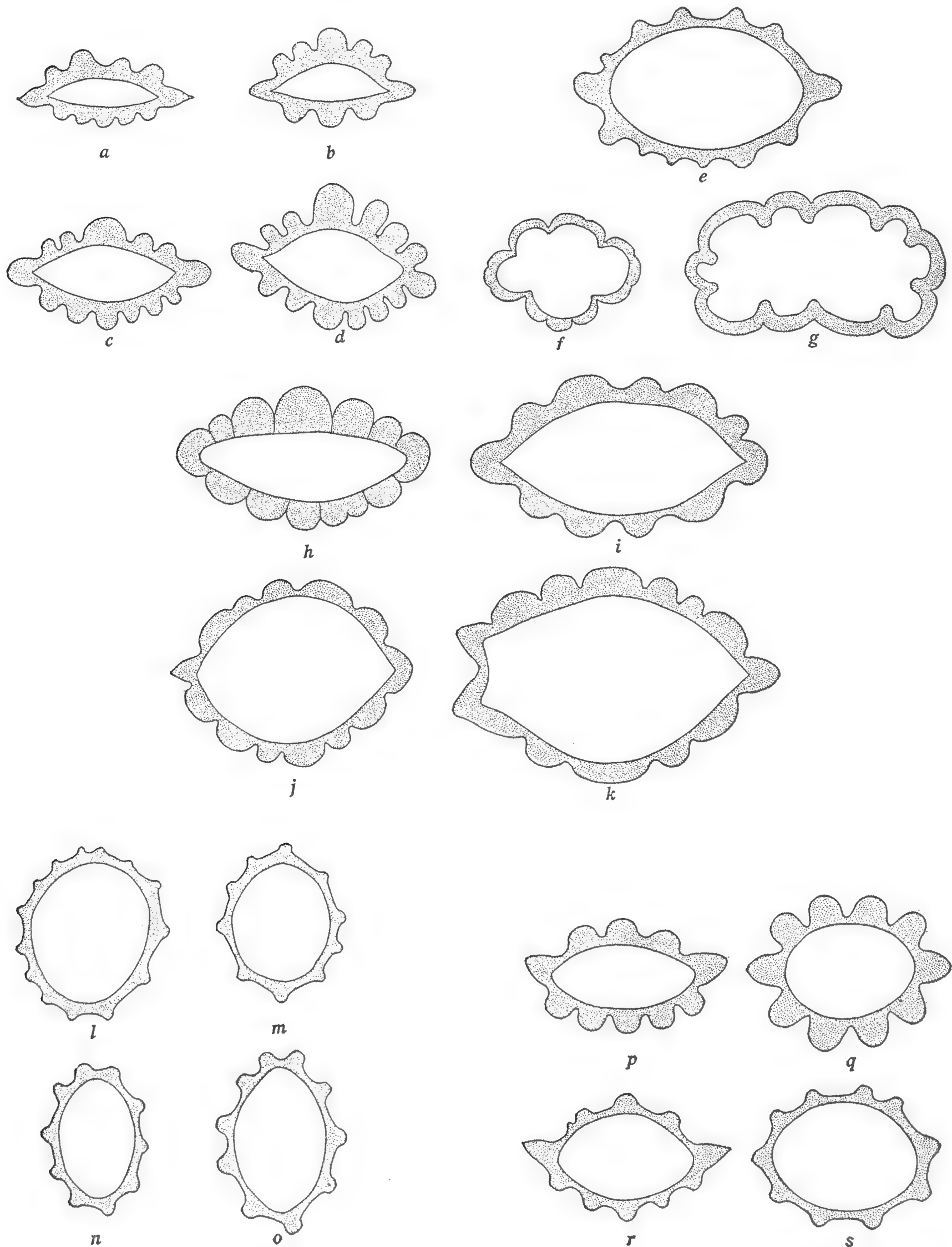


FIG. 1—Cross-sections of achenes. When two drawings represent a species, the first shows a marginal and the second an inner achene. In *e-k* only marginal achenes are shown. *a, b*, *Youngia japonica*; *c, d*, *Y. paleacea*; *e*, *Y. stenoma*; *f*, *Y. scaposa*; *g*, *Y. depressa*; *h*, *Y. tenuifolia typica*; *i*, *Y. tenuifolia altaica*; *j*, *Y. tenuifolia tenuicaulis*; *k*, *Y. tenuifolia diversifolia*; *l, m*, *Crepis capillaris*; *n, o*, *C. parviflora*; *p, q*, *Ixeris chinensis*; *r, s*, *I. denticulata*.  $\times 30$  approx.



are as nearly as possible equal in number on the two surfaces. In most species they are, at least in the outer achenes, shorter and less elevated as well as narrower than the five principal ribs, but in *Y. tenuifolia* they may be as long and as high. A variation on this pattern is found in *Y. japonica* and its immediate relatives, in which the outer achenes often bear only one stronger rib and three or four secondary ones on each surface, and are therefore tetrahedral. This occurs in occasional achenes of several species. In a few species, particularly *Y. paleacea*, the ribs on the dorsal surface are in some achenes all nearly equal, making the achene more or less trihedral.

Besides these differences, three other tendencies may be noted. In *Y. depressa* the stronger ribs are usually broad and flattened, in strong contrast to the much narrower secondary ones (fig. 1, *g*). In *Y. scaposa* the basic structure is essentially the same, but the ribs are less clearly differentiated; in mature fertile achenes there are four or five principal ribs which are usually separated by rather narrow grooves, and these principal ribs are less definitely divided into two or three unequal secondary ones which sometimes are obviously shorter than the principal ribs (fig. 1, *f*). In *Y. tenuifolia* the achenes, especially the inner ones, are sometimes nearly terete, and the difference between the ribs is one of breadth rather than of length or degree of elevation; but the marginal achenes are more or less compressed (fig. 1, *h-k*).

The basis of the pattern of the ribbing is, of course, the vascular anatomy of the ovary and fruit. Although detailed studies of this feature have not been carried out on *Youngia*, a diagrammatic view of the number and course of the bundles in the ovary at anthesis could be obtained by boiling, first in water, then for a minute or so in a strong solution of ammonium hydroxide, florets and ovaries at anthesis obtained either from fresh material or from well-preserved herbarium specimens. The treatment in ammonium hydroxide is best carried out with the floret on a slide and under a cover glass, since the tissue becomes so soft after this treatment that it cannot be moved without damage. The cover glass exerts a slight pressure on the ovary as it becomes softer, spreading out the bundles, so that if care is taken to obtain just the correct length of treatment in ammonium hydroxide, the entire vascular system may be traced out under the low power of the microscope.

The most usual structure resembles that described for *Hypochaeris* by Henslow (Jour. Linn. Soc. Bot. 28:151-197, 1890). It consists of five bundles which traverse the length of the ovary, and about which the five principal ribs of the achene are formed. Each of these gives rise, at its apex, to a bundle pass-



ing into the corolla and one to a filament, while two of them branch slightly below the summit to give rise to the bundles passing into the style. In the outer florets of *Y. japonica*, and in other ovaries destined to give rise to tetrahedral achenes, the number of bundles is reduced to four.

In the species of the sections *Desiphylum* and *Stenophytum* there are, in addition to the five functional bundles, supernumerary, smaller bundles which end at the summit of the ovary or below, and often do not develop tracheids until the time of anthesis. The number of these bundles varies from 2–3 in *Y. conjunctiva* to 7–10 in *Y. simulatrix*, a species in which at least some achenes may have a different fundamental structure, although the material available of it was too poorly preserved to permit a detailed study.

6. *Floral details.* The relative length of the corolla-tube and ligule is fairly constant. In general, the corolla-tube is from one-fifth to one-third as long as the whole corolla. In only two species, *Y. stenoma* and *Y. depressa*, does it approach the ratio one-half, and in the latter species it is variable. The ligule is always five-toothed, except occasionally in *Y. japonica*, and the anther-tube is nearly always green. In the more minute details of structure there is much variation between species, and some of these are noted in the descriptions, since it has been found that, as a rule, even these small details are highly constant within a species.

7. *Pubescence.* Although several species are entirely glabrous, the genus may be said to be characterized by the nature of the indumentum on leaves, stems, or, in one species, the involucre. This consists of many-celled piliform trichomes which vary considerably in length and width on different parts of the plant and sometimes in different species. Three species have brown wool at the base of the leaves or on the lower surface of the leaves or at the nodes. One species is canescent-tomentose on stem and peduncles. The involucre is generally glabrous on the outside; one species has piliform trichomes, another has setiform hairs, and a third has short glandular hairs on the bracts. The inner face of the inner involucreal bracts is either pubescent with short appressed hairs or glabrous. The corolla-tube is either glabrous or pubescent, and the type of pubescence is peculiar to each species. These last two pairs of characters are useful in distinguishing between species.

8. *Underground parts.* There are three annual species, the others being perennial or possibly biennial in two or three cases (two of these have been described doubtfully as perennial). The annual species are characterized by weak, finely fibrous roots. The perennials usually have a narrow, leafy caudex

which is prolonged into a woody taproot. In certain species the rootstock is rhizomate. Two species are stoloniferous.

#### RELATIONSHIPS OF YOUNGIA

The genus *Youngia* belongs to the tribe Cichorieæ, family Compositæ, and, since its pappus is of numerous, nonplumose bristles, falls into the subtribe Crepidinæ, as defined by Hoffmann (Pflanzenfam. 4(5):366, 1891). It closely resembles *Crepis* in its corollas, anthers, styles, style-branches, and the attenuate or shortly beaked achenes of all the species except *Y. scaposa*. The chief differences between *Youngia* and *Crepis* may be set forth as follows. In habit, there is a tendency for the species of *Youngia* to have larger aggregate inflorescences and smaller heads than most species of *Crepis*. Although many species of *Crepis* have larger inflorescences than *Y. conjunctiva*, for instance, and the distinction between the two genera is, therefore, not sharp, there is no species of *Crepis* that approaches *Y. japonica* in the number and small size of its heads, while, conversely, no species of *Youngia* bears large heads singly or in twos and threes, as is the case in a large number of species of *Crepis*, such as *C. aurea* (L.) Cass., *C. pontana* (L.) Dalla Torre, and *C. alpestris* (Jacq.) Tausch. The involucre differs from that of most species of *Crepis* in being uniformly calyculate, i.e. with the small outer bracts mostly broad and closely imbricated, and in having fewer florets. Furthermore, in the great majority of the species of *Youngia* the bracts are glabrous on the outer surface, whereas, with few exceptions, those of *Crepis* species are tomentulose or setose. There are, however, species of *Crepis*, such as *C. flexuosa* (DC.) Benth. et Hook. f., *C. nana* Richards., and *C. acuminata* Nutt., in which in all of these three characteristics the involucre is exactly like that of *Youngia*. In these, however, the achene is in every respect typical of *Crepis*. As has been noted above, the achene characters are the most important for the distinction of the two genera. There is no species of *Crepis* in which both the shape and the ribbing of the achenes approach those described above as typical for *Youngia*. *Y. tenuifolia*, however, sometimes has achenes which, both in their relative lack of compression and in the character of their ribbing, approach those of *Crepis*. Furthermore, at least some subspecies of it show a strong habital resemblance to *C. flexuosa*, with which their range coincides in part, so that *Y. tenuifolia* must be considered in some respects a transitional species, and is the only observable connecting link between the two genera. Both *Y. tenuifolia* and *C. flexuosa* are, however, more or less isolated within their respective genera. The former is in a section by itself, and its nearest relatives, *Y. Pratti* and *Y. Henryi*,

resemble it in habit alone, being in both their involucre and their achenes typical of *Youngia*. As pointed out by Babcock and Cameron (Univ. Calif. Publ. Bot. 6:296, 313, 1934), *C. flexuosa* forms with *C. nana* and *C. elegans* Hook. an isolated group of species with no close relatives in the genus. Furthermore, it is obvious that this connecting link does not represent a primitive phyletic stock from which the two genera, or even one of them, originated. The section *Crepidopsis* is, as indicated below, near the middle of the genus in its phyletic position, while (Babcock and Cameron, *loc. cit.*) *C. flexuosa* belongs in the middle subgenus, *Eucrepis*, of *Crepis*, and, although undoubtedly an old species, as is indicated by the geographic distribution of its close relative *C. nana*, is not primitive in its morphological characteristics and certainly cannot be considered as ancestral to the other species of *Eucrepis*. Hence the connection between *Youngia* and *Crepis* through *Y. tenuifolia* and *C. flexuosa* must be considered as due either to parallel or convergent evolution as a result of the similar environment of the two species, or to the exchange of genes through interspecific hybridization when the genera were in a formative stage.

To *Ixeris*, *Youngia* shows a much closer relationship than to *Crepis*. Both genera agree, not only in pappus, corolla, anthers, and style-branches, but also in their involucre, which in *Ixeris* are always calyculate, glabrous, and characteristically few-flowered. In habit there is also considerable resemblance. Some species, such as *I. gracilis* (DC.) Stebbins and *I. dentata* (Thunb.) Nakai, have large, paniculate inflorescences like those of most species of *Youngia*, but the tendency in *Ixeris* is more toward lower, often decumbent or stoloniferous stems, leafless scapes, and relatively few-headed inflorescences, and the leaves are usually smaller, and more often entire or merely dentate. As mentioned above, the achenes in the two genera are about equally compressed, and in both, the outer achenes are considerably more compressed than the inner. Those of *Ixeris*, however, are always more or less beaked, and usually strongly so, and they possess typically ten equal ribs, which are usually more elevated than are those of *Youngia* achenes, and are often alate. The nearest approach to *Youngia* in the genus is *I. denticulata* (Houtt.) Stebbins and the other species placed by Nakai (Bot. Mag. Tokyo 34:155–157, 1920) in his genus *Paraixeris*. After careful consideration, the junior author has found it impossible to maintain this genus (Stebbins, Jour. Bot. London 75:43–51, 1937). Nevertheless, the achenes of *I. denticulata* are as near to those of *Youngia* in their more numerous, occasionally unequal ribs, and in their short beaks, as they are to those of typical *Ixeris*. Furthermore, *I. denticulata* has the tall stems and large



panicles characteristic of *Youngia* section *Euyoungia*, although its leaves are much more like those of *Ixeris*, particularly the subgenus *Crepidiastrum*. To the latter subgenus *I. denticulata* is considerably closer than it is to *Youngia*. The species of *Ixeris*, subgenus *Crepidiastrum*, since they have terete, equally ten-ribbed, beakless achenes, and are in habit generally suffrutescent, with entire, cordate-clasping stem leaves, are less closely related to *Youngia* than is *I. denticulata*, and both are in their pappus structure, and *Crepidiastrum* is in its ovary anatomy as well, as primitive as the more primitive species of *Youngia*. Since, moreover, the only species of *Youngia* which approach *I. denticulata* are those of the most advanced section, *Euyoungia*, the relationship between *Youngia* and *Ixeris* through *I. denticulata* is probably one of parallel or convergent evolution rather than of common origin. *Youngia* and *Ixeris*, nevertheless, undoubtedly form a closely related group of genera with a similar geographical distribution, which are well set off from *Crepis*, as mentioned above, and are still more remote from *Lactuca* or any other well-known genus of the Cichorieæ, as will be indicated below.

The great majority of *Lactuca* species are very different from *Youngia* not only in habit but in their well-imbricated involucre, slender, weak pappus bristles (class C of Lund, Bot. Tidsskr. 1872:159), and much more flattened achenes, the number of vascular bundles in the ovary at anthesis being reduced to two or three. A few species of *Lactuca* possess calyculate, few-flowered involucre. One of these, *L. muralis* (L.) Fresen., is the type species of Cassini, genus *Mycelis*, to which genus or section De Candolle (Prod. 7:193) suggested that his *Y. napifolia* (= *Y. japonica*) was related. *L. muralis*, however, is quite typical of *Lactuca* in its habit and corollas and in the structure of its achenes and pappus, and shows a definite relationship to *L. deltoidea* DC., and through it to the large number of species of *Lactuca* in Asia Minor. The other species of *Lactuca* with calyculate involucre, *L. graciliflora* DC., *L. sororia* Miq., and their relatives, are somewhat more closely related to *Youngia*. Their achenes are less compressed than those of most *Lactuca* species, and not more so than are the outer achenes of *Youngia*. Most of these species, moreover, have achenes which are only very shortly beaked, and not more so than *Y. fuscipappa* or *Y. rubida*. However, aside from the greater prominence of the lateral ribs, characteristic of all species of *Lactuca*, and the occasionally more prominent ventral one, also found in many species of that genus, the achenes of this group are equally ribbed. Furthermore, the pappus practically always contains some bristles which are not more than four cells in cross-section at



the base, a characteristic never found even in the most reduced species of *Youngia*, and common to all species of *Lactuca*; and the number of vascular bundles in the ovary is almost always three or four. These species, moreover, are tall, leafy-stemmed plants with narrow panicles quite unlike those of *Youngia*; their corollas are mostly violet or rose color (pale yellow only in *L. yunnanensis* Franch.), and the corolla tube is very long, equaling or exceeding the much reduced ligule, and is pubescent with long hairs at the apex, a characteristic typical of *Lactuca* but not found at all in *Youngia*. The species of this group which approaches most closely to *Youngia* is that described by Hemsley as *Crepis prenanthoides*, i.e., *L. chungkingensis* Stebbins (Jour. Bot. London 75:15, 1937). This species approaches *Youngia* in pappus structure, as well as in its ovary anatomy and achene shape, but since in all these characteristics it also approaches several species of *Prenanthes*, particularly *P. khasiana* Clarke and *P. Henryi* Dunn, to which, along with all the other species in this section of *Lactuca*, it is much more closely allied in habit and other floral characteristics, this feature is here of relatively little significance. Hence the writers believe that the close resemblance between the achenes and involucre of these species of *Lactuca* and those of both *Youngia* and *Ixeris* is but a superficial one or a result of parallel evolution, and not indicative of any close relationship between them.

To the other recognized genera of the Cichorieæ, *Youngia* is only distantly related. Its involucre resembles those of *Prenanthes*, but no more so than do those of *Ixeris*, *Crepidiastrum*, and the species of *Lactuca* just mentioned, all of which are closer to *Youngia* in other characteristics. The tetrahedral outer achenes of *Y. japonica* are much like those of *Sonchus*, but this genus is very remote in habit, involucre, pappus, and every other characteristic.

The only other definite relationship of *Youngia* is to a group of species which have been alternately placed in *Lactuca* and in *Crepis*, but which in the opinion of the writers constitute a genus by themselves. The best known of these, and that most nearly related to *Youngia*, is *Dubyæa hispida* (Don) DC. (= *Lactuca Dubyæa* Clarke or *Crepis Dubyæa* Marq. et Shaw), but several others more recently described in various genera have obviously closer relationships to this species than to typical species of any of the recognized genera. They all agree in having more or less flattened achenes which, like those of *Youngia*, have nevertheless five main ribs, corresponding to the five chief vascular bundles of the ovary, and usually several secondary ones. They differ from all species of *Youngia* in their much larger, many-flowered heads, and in their involucre, usually well imbri-

cated or with the outer bracts not markedly shorter than the inner. They all have the strong pappus and the relatively broad, somewhat flattened style-branches found in *Youngia* section *Desiphylum* and in other primitive species of Crepidinæ, and all possess the supernumerary vascular bundles in the ovary characteristic of these primitive species. A full treatment of these species is in preparation, but their relationships to *Youngia* may be enumerated here. Both *Dubyæa hispida* DC. and *D. oligocephala* (Sch. Bip.) Stebbins have achenes resembling those of *Y. depressa*, and *Y. conjunctiva* approaches the first mentioned in its general habit and inflorescence, although differing very markedly in the much smaller size of both its vegetative and floral parts, and in its essentially glabrous character. Nevertheless, since the evolutionary tendency throughout *Youngia* has been toward reduction, particularly in the floral parts, and since in their floral and achene characteristics there is a striking resemblance between these large-headed species and the most primitive section of *Youngia*, the most reasonable hypothesis for the derivation of the genus is from species resembling this group.

Finally, *Y. depressa*, in habit and leaves, as well as in its exceptionally long corolla-tube, resembles the species known as *Crepis Umbrella* Franch., which finds its closest relatives in that peculiar group designated as *Crepis* section *Glomeratæ* by Hooker (Flora Brit. Ind. 3:398, 1882). This group was little known to Bentham and Hooker and to Hoffmann, by whom it was briefly mentioned under section *Youngia* of *Crepis*. In the type species of the group (*Prenanthes glomerata* DCne.) and the other species which may properly be referred to it, the achenes and style-branches are closely similar to those of typical species of *Prenanthes*. But the structure of the involucre is unique, and in the opinion of the present writers, the *Glomeratæ* should be recognized as a distinct genus. A treatment of these species is also in progress. *C. Umbrella*, while typical of the group in floral characteristics, links it both with *Y. depressa* and more closely with *Dubyæa* through its foliage and broad, relatively many-flowered involucre. Hence the relationship between *Y. depressa* and *C. Umbrella* is relatively indirect.

In considering generic relationships within this group, the writers have felt that the nearest approach to a natural system will be attained, not by segregating species sharply into genera by means of one or two predetermined characteristics, however striking and apparently fundamental these may be, but by considering carefully the interrelationships of species and groups of species based on all of the criteria available, and then segregating groups of species that appear to compose a unified, either

completely or nearly monophyletic line, and using as criteria for their separation such differences, however subtle they may appear at times to be, as hold most consistently to separate one from another these unified groups. The result is that many of the generic distinctions here discussed would not hold at all in neighboring genera. In *Lactuca*, for instance, species with equally and with unequally ribbed achenes occur in the same genus, but these species are otherwise closely interrelated, and not set apart from each other as are the species of *Youngia* and *Crepis*. In *Taraxacum*, on the other hand, the difference between four-angled and five-angled achenes is of no great value, since it separates species otherwise very similar (cf. Handel-Mazzetti, Monogr. Gatt. *Taraxacum* 9, 1907); but as between *Youngia* or *Ixeris* and *Lactuca* it serves to separate species that in the sum of their other characteristics are quite different. Furthermore, no two genera of the Cichorieæ have yet been found which, judging them on this basis, are not connected by at least one line of transitional species. Hence, in separating genera as wholes, some criteria must be regarded as important, even though they are transgressed by one or two exceptional species. It is for this reason that, in defining *Youngia*, weight has been placed on the character of the involucre and the compression of the achenes, even though the former is equaled by some species of *Crepis*, and the latter is violated to some extent by forms of *Y. tenuifolia*. In any complex system of living things, the natural order is usually not the one most easily perceived by man, and it is toward this order that we are striving.

The cytological evidence, although limited, supports the conclusions obtained from other sources. As first reported by Tahara (Bot. Mag. Tokyo 24:23-27, 1910) and verified by Mann (Univ. Calif. Publ. Agr. Sci. 2:299, 1925) and Babcock and Lesley (*ibid.*, 2:228, 230, 1926), *Y. japonica* has 16 somatic chromosomes and is apparently diploid, and the same number has been found in *Y. fuscipappa* (Babcock and Lesley, *op. cit.*, 331) and *Y. depressa* (as *Lactuca depressa*, Babcock and Cameron, Univ. Calif. Publ. Agr. Sci. 6:289, 1934). *Y. stenoma* is also a diploid with 16 chromosomes and in *Y. paleacea* the somatic chromosome number is 32, according to Jenkins (unpublished). In the latter the genom appears to be that of a polyploid with 8 as the basic number, a situation also unknown in *Crepis*. The only other species thus far examined cytologically is *Y. tenuifolia*, in which variation in chromosome number has been reported (Babcock and Cameron, *op. cit.*, 307, 308) and the basic number may be 5. This is considered the most primitive number in the genus *Crepis*, and its occurrence in this transitional species of *Youngia* may indicate the nature of the phyletic connection between the



two genera. It is interesting that some species of *Crepis* transitional to *Youngia*, *C. flexuosa* and *C. nana*, have the basic number 7, which is nearer to that of *Youngia* than to that of typical species of *Crepis*. Our present knowledge about the chromosomes of *Youngia*, however, is too meager to warrant any general hypothesis about intergeneric phyletic relations. Within the genus, the principle observed in *Crepis* (Babcock and Cameron, *op. cit.*, 322), that reduction in size of the chromosomes accompanies reduction in size and specialization of the plant, seems to hold. This is indicated by the numerous, very small heads and the greatly reduced flowers and fruits in *Y. japonica*, one of the most advanced and specialized species in the genus. This species has smaller chromosomes than those of the other five which have been examined cytologically, and these species are all relatively more primitive. This cytological evidence has been supplemented by measurements on size of stomata and pollen grains in the four species named above and in several other species. The combined evidence supports the inference that in *Youngia* reduction in size of the chromosomes generally accompanies advancement with specialization in the plant as a whole.

The relationship of *Youngia* with *Ixeris* is further supported by a comparison of the cytology of the two genera. As reported by Ishikawa (Bot. Mag. Tokyo 35:153, 1921), the basic number in most species of this genus is 8, and the small size of the chromosomes in these species strongly resembles that of *Y. japonica*. Another point of resemblance is the presence in both genera of a pair of chromosomes with median constrictions and unusually large satellites, a type occurring very rarely in *Crepis*.

The typical species of *Lactuca* have a diploid set of 18 rather large chromosomes (Ishikawa, *loc. cit.*), and an examination now in progress of a large number of species, representing the majority of the sections, has as yet failed to reveal any striking deviations from this complement, and nothing approaching that of either *Youngia*, *Ixeris*, or *Crepis*.

#### RELATIONSHIPS OF THE SECTIONS

Although our knowledge of *Youngia* is as yet too incomplete to warrant a full phylogenetic treatment of the genus, certain tendencies may be noted which have served as a guide in grouping the species into sections, and in determining the relative position of the sections. The most important of these tendencies is that toward reduction in size of all the floral parts and in the number of florets per head, accompanied by an increase in the number of heads per inflorescence. In addition, there are various types of specialization, such as the reduction of the

cauline leaves, the contraction of the inflorescence, and the sharper differentiation into two series of the involucral bracts.

Judging them by these criteria, the position of at least two of the sections can be definitely determined. The species of section *Desiphylum*, with their large heads, well-developed outer involucral bracts, strong pappus, and broad, somewhat flattened style-branches, and the highly developed vascular anatomy of their ovaries, are undoubtedly the most primitive of the genus. Their only specialization is the development of the tufted habit as a response to alpine conditions. Furthermore, they show definite relationships to *Dubyæa* and other primitive types which may be considered the nearest relatives among known species of the ancestors of *Youngia*. The other sections were probably developed from forms resembling *Desiphylum* in their involucre and floral characteristics, but without the alpine habit. The nearest approach to this condition is in *Y. conjunctiva*, which also resembles several species of section *Mesomeris* in habit, and can therefore be considered a connecting link between section *Desiphylum* and the rest of the genus.

The section *Euyoungia* is, conversely, without doubt the most advanced. Most of the species are annuals, and apparently weeds; the best known, *Y. japonica*, is a widespread tropical weed. All have large inflorescences of very small heads, and the size of their floral parts is correspondingly reduced. Their connections are with section *Mesomeris*, but no species of that section resemble them very closely in habit. *Y. terminalis* is fairly close to *Y. heterophylla* in both leaf and floral characteristics, and this probably forms the closest link between the two sections.

The position of section *Mesomeris* is intermediate between sections *Desiphylum* and *Euyoungia*. Through *Y. fusca* and *Y. Wilsoni* section *Mesomeris* approaches, though not very closely, section *Desiphylum*; whereas, in addition to *Y. Henryi* and its close relative *Y. Pratti*, a third species, *Y. cineripappa*, approaches section *Euyoungia*, chiefly in its large inflorescences of relatively small heads. Hence the relationship of section *Mesomeris* appears to be closest to section *Euyoungia*.

The other three sections are all at present monotypic, and represent divergences from the primitive stock in entirely different directions.

*Y. stenoma* is the most primitive in floral characteristics of any species outside of section *Desiphylum*, but in its involucre, particularly the well-developed claws on the inner bracts, it suggests *Y. paleacea*, and its inflorescence is best regarded as derived, by reduction in length of the lateral branches, from that characteristic of section *Mesomeris*. Hence *Y. stenoma* may

have been derived from transitional forms resembling *Mesomeris* in habit and *Desiphylum* in floral characteristics, but has developed a number of striking specializations.

*Y. scaposa* most resembles some species of section *Euyoungia* in habit, but in its few-flowered heads and in the shape of its achenes it is unique in the genus, and its relationships are obscure.

*Y. tenuifolia*, as mentioned above, is transitional toward *Crepis*, but in *Youngia* it finds its closest relatives in section *Mesomeris*. *Y. Pratti* closely resembles it in habit, but in involucre and achene characteristics, particularly the prominence of the claws on the bracts and the relative indefiniteness of the primary ribs on the dorsal surface of its achenes, *Y. tenuifolia* is nearest to *Y. paleacea*.

### GEOGRAPHIC DISTRIBUTION

It has been shown (Babcock, in *Essays in Geobotany in Honor of William Albert Setchell*, Univ. Calif. Press, 1936) that south central Asia is an important center of distribution for the Crepidinæ, particularly for *Crepis* and several closely related genera, including *Youngia*. When individual genera are considered, however, various modifications of such a general statement become necessary. *Crepis* is a comparatively ancient genus, while *Youngia* is comparatively recent. The former has several important centers of distribution, which in itself indicates an earlier origin, but the distribution of the latter is typically that of a younger genus. The geographic area of *Youngia* is bounded on the east and south by the Pacific Ocean, except for the widespread *Y. japonica*, and on the west and north by the Pamir-Altai cordillera, except for *Y. tenuifolia*, which crosses those barriers. The genus *Ixeris* occupies much the same area, but in *Youngia* there has been a tendency to spread westward, since the most outlying species occupy stations in Ceylon, Kashmir, Pamir, Semipalatinsk, and the Baikal region; whereas in *Ixeris* the extension of range has been to the east and south, since the marginal stations occur in the Philippines and the Malaysian Archipelago. In both *Youngia* and *Ixeris*, the most advanced species show their youth by their aggressive, weedy nature, even such relatively restricted species as *Y. heterophylla* and *Y. scaposa* having been found chiefly on roadsides.

The distribution of the sections of *Youngia* is consistent with our concepts of their phylogenetic relations as based on morphological evidence. The most primitive species, section *Desiphylum*, are found in the eastern two-thirds of the Himalaya Range, in northern India and southern Tibet, and in the eastern extension of that range in western China. The most advanced sec-



tion, *Euyoungia*, occupies chiefly an area extending from western China to the ocean together with Formosa and Japan. Furthermore, the more primitive species of this section, *Y. heterophylla*, *Y. bifurcata*, *Y. Rosthornii*, and *Y. longipes*, occur mostly in the western portion of the area, while the more advanced species, *Y. japonica*, *Y. rubida*, and *Y. erythrocarpa*, are either widespread or mainly in the eastern portion.

The species of section *Mesomeris* correspond in their distribution to their intermediate phyletic position. *Y. cineripappa* occupies a central position with reference to the range of the genus, with a doubtful extension into Ceylon. It occurs in eastern India and southwestern China, also probably in Burma. Its two nearest relatives are at the outskirts of this range to the south and west. *Y. paleacea* and its three close relatives *lanata*, *fusca*, and *Mairei* all occur in western China, mostly in Yunnan; and the other four species, *Wilsoni*, *Pratti*, *Henryi*, and *terminalis*, are distributed in western and central China.

The monotypic section *Hieraciella* occurs in the same area as section *Mesomeris*, but both of the other two monotypic sections range far beyond any other species of the genus. *Y. stenoma*, a diploid species, is restricted to Outer Mongolia and southern Siberia. *Y. tenuifolia* ranges through southern Siberia and Outer Mongolia into Turkestan and northern India. Its extensive range may be explained in large measure as a result of its polyploid nature and polymorphism, which has enabled it to become adapted to a wide range of habitats, many of them very unfavorable for plant life (cf. Müntzing, *Hereditas* 21:288–300, 1936).

In general, the distribution of the genus taken as a whole is entirely consistent with the conception that it is a natural group which had its origin in southeastern Asia and that evolution has been accompanied by extension of the geographic range to its natural limit on the south and east and slightly beyond the great mountain barrier to the north and west.

## MATERIAL AND METHODS

Only five species of *Youngia*, viz., *fuscipappa*, *japonica*, *paleacea*, *stenoma*, and *tenuifolia*, have been seen by the authors in living condition. These were cultivated at Berkeley from seeds obtained through the courtesy of other botanists. Study of the plants in their native habitats has not been attempted. Notes by collectors on distribution, plant associations, and ecology are almost entirely lacking. The present study, therefore, is necessarily limited mainly to herbarium material, and for many of the species this material is very scanty. Furthermore, the geo-

graphic area represented is extensive and but little explored. Undoubtedly there are undiscovered species, perhaps many, in the less accessible regions. Hence it is realized that the present treatise is merely a first step toward a more adequate knowledge of this portion of the Crepidinæ.

Species and subspecies and formæ are the subgeneric taxonomic units recognized in the present treatise. The concept of species as natural entities, populations, or systems of individuals which are more similar morphologically and genetically to one another than to those of any other entity, population, or system, is consistent with the combined evidence from taxonomy, genetics, cytology, and distribution (cf. Babcock, Amer. Nat. 55:5-18, 1931). But so-called Linnæan species differ widely in degree of uniformity or polymorphism within the population or system; and the recognition of subspecific categories is still largely a matter of individual judgment or personal preference. The subspecies, however, is generally recognized as a major subspecific entity or group which is clearly set off from other portions of the species in certain morphological details and which occupies a restricted geographic area within the distribution of the species as a whole. When such major subspecific entities are encountered, it is necessary to recognize them by the use of trinomials. Lesser variant forms within the species are merely listed by number. The recognition of varieties by the use of quadrimomials has not been found necessary in the present work.

The present investigation has extended over a period of years in connection with the studies of the senior author on the genus *Crepis*. During this time some species of *Youngia* have been studied in several European herbaria, and more recently critical material has been borrowed from various institutions. For each species the type or an authentic specimen has been examined and photographs and fragments from such specimens are on file. The collections in the University of California Herbarium have been continually at our disposal.

The diagnoses of species and sections are consistent as to sequence of structures described and units of measurement employed. Smaller structures such as the corolla and its parts, the anther-tube, anther-appendages, and style-branches have been measured in boiled material. These and the achenes and pappus were examined under binocular dissecting and low-power compound microscopes. Details of the indumentum were studied in the same way. As a general rule several florets, achenes, or other parts were examined, and the figures given represent averages, as a rule, from which more or less deviation must be expected in any given specimen. In each case the measurements of flower parts were taken from marginal florets.

The illustrations are based on line drawings supplemented by five half-tone plates of herbarium specimens. The drawings were prepared by Miss Anna Hamilton, to whom the authors are indebted for painstaking care in the work. All the drawings of corolla, anther-tube, and anther-appendages were first made by the senior author and incorporated in the plates by the artist. The scale of reproduction is uniform for heads, flowers, and fruits (except in certain details where noted in the legend) and is as follows: head,  $\times 2$ ; involucral bract,  $\times 4$ ; corolla,  $\times 4$ ; anther-tube, dissected and opened out to form a rectangle,  $\times 8$ ; anther-appendages,  $\times 32$ ; achene,  $\times 8$ ; pappus-bristle,  $\times 8$ .

Citation of herbarium specimens follows consistently the following order for both species and subspecies: (1) location; (2) collector's name and number or year of collection, the collector's name and number being italicized but not year of collection when given; (3) herbaria possessing the specimens seen by the authors, indicated by abbreviations; (4) occasional brief remarks concerning specimens cited. Under forms the same data are given, but in a different order, as follows: (2), (3), (1). In certain American herbaria each sheet bears a number. These folio numbers have been included only in citations of type specimens and certain critical specimens and forms. The following abbreviations for herbaria have been used:

B, Herb. Berol.—Herbarium of the Botanical Museum and Gardens, Berlin

BB—Barbey-Boissier Herbarium, Institute of Botany, University of Geneva

BM—Herbarium, British Museum (Natural History), London

CA—Herbarium, California Academy of Sciences, San Francisco

Calcutta—Herbarium of the Calcutta Botanic Garden

DC—De Candolle Herbarium, Botanical Conservatory, Geneva

DL—De Lessert Herbarium, Geneva

E—Herbarium, Royal Botanic Garden, Edinburgh

Fl—Herbarium, Institute of Botany, University of Florence

G—Gray Herbarium, Harvard University

K—Herbarium, Royal Botanic Gardens, Kew

Lenin—Herbarium, Institute of Botany, Academy of Sciences, Leningrad

Mo—Herbarium, Missouri Botanical Garden, St. Louis

Mosc—Herbarium, University of Moscow

Mu—Herbarium, Botanical Museum, University of Munich

MW—Herbarium, Natural History Museum, Vienna

Nanking—Herbarium, National Central University, Nanking

NY—Herbarium, New York Botanical Garden

P—Herbarium, Museum of Natural History, Paris

Po—Herbarium, Pomona College, Claremont, California

UC—Herbarium, University of California, Berkeley



Upsala—Herbarium, Botanical Institute, University of Upsala  
US—National Herbarium, Smithsonian Institution, Washington  
UWG—General Herbarium, Botanical Institute, University of Vienna  
UWK—Keck Herbarium, Botanical Institute, University of Vienna  
Wellesley—Herbarium, Department of Botany, Wellesley College

#### ACKNOWLEDGMENTS

To the administrative officers of the various herbaria where specimens were studied and from which specimens were borrowed thanks are due for the many courtesies rendered. The following persons or organizations have assisted by sending seeds of the five species which have been studied cytologically: Dr. N. Vavilov, Dr. M. Navashin, Dr. H. Krashenninikov, Dr. R. R. Stewart, Dr. Joseph Rock, Dr. Venkata Rau, G. Ghose and Company, and The Botanic Garden, Buitenzorg, Java.

## DIAGNOSES OF SECTIONS

SECTION 1. **Desiphylum.** Low perennial herbs; plant usually  $\pm$  pubescent; caudex up to 6 mm wide, woody, leafy at the crown; leaves petiolate, denticulate, dentate, or pinnate; stem absent, obscure, or short (rarely up to 10 cm long), the branches pedunculate or 2-headed, aggregate inflorescence tufted or shortly paniculate; heads medium, 15- to 30-flowered; outer involucre bracts  $\frac{1}{4}$  to  $\frac{1}{2}$  as long as the inner; corolla 14 to 17 mm long; achenes brown, brownish or purplish yellow, or dark green, 3.5 to 7 mm long, compressed,  $\pm$  attenuate or shortly beaked, 10- to 15-ribbed; pappus yellow, yellowish white, white and brown at base, or white, 5 to 11 mm long. Type species: *Y. conjunctiva* Babcock and Stebbins.

SECTION 2. **Stenophytum.** Perennial herb; plant glabrous; caudex up to 1 cm wide, woody; caudical leaves lanc-linear, dentate to entire, petiolate, glaucescent,  $\pm$  fleshy; cauline leaves numerous, gradually reduced; stem simple, fastigiately branched from middle to apex, branches short, 1- to 3-headed, aggregate inflorescence a racemiform panicle; heads small, 9- to 11-flowered; outer involucre bracts up to  $\frac{1}{3}$  as long as the inner; inner bracts crested; corolla 12 mm long; achenes greenish brown, 4.5 to 5 mm long, subcompressed, gradually attenuate to the rather broad summit, 12- to 14-ribbed; pappus white, 2-seriate, unequal, 4 to 6 mm long on the same fruit, deciduous in a ring. Type species: *Y. stenoma* (Turcz.) Ledeb.

SECTION 3. **Hieraciella.** Perennial herb; plant pubescent; caudex slender, woody, leafy at the summit, brown-woolly at the bases of the leaves; caudical leaves shortly petiolate, lyrate; cauline leaves bractlike; stem elongate, branched above, aggregate inflorescence cymose-corymbiform; heads small, mostly 5-flowered; outer involucre bracts up to  $\frac{1}{4}$  as long as the inner; corolla about 7 mm long; achenes brown, about 2 mm long, subterete, only slightly attenuate upward, not constricted at the summit, 10- to 13-ribbed; pappus yellow, about 4 mm long, 1-seriate, united at base, persistent. Type species: *Y. scaposa* (Chang).

SECTION 4. **Crepidopsis.** Perennial herb; plant glabrous except at the caudex, involucre, and corolla-tube; caudex simple and up to 8 mm wide or 2- to 4-divided and up to 4 cm wide, scaly with bases of old petioles, leafy above; caudical leaves pinnately parted into linear or filiform segments, lateral segments simple or incompletely pinnatifid; cauline leaves similar or sessile or entire and bractlike; stem or stems strictly or divaricately branched, aggregate inflorescence corymbiform or racemiform; heads medium, 9- to 16-flowered; outer involucre bracts from less than  $\frac{1}{4}$  up to  $\frac{1}{2}$  as long as the inner; corolla 10 to 20 mm long; achenes black or brown, 3.5 to 7.5 mm long,  $\pm$  compressed or angular,  $\pm$  attenuate upward, 10- to 12-ribbed; pappus white or yellowish white, 4 to 7 mm long, 1- to 2-seriate, persistent. Type species: *Y. tenuifolia* (Willd.).

SECTION 5. **Mesomeris.** Perennial herbs; plant  $\pm$  pubescent or glabrous; caudex up to 1 cm wide, woody, prolonged into a taproot or strongly fibrous, usually scaly with bases of old petioles, leafy above; caudical leaves denticulate to runcinate-pinnatifid or the later ones becoming pinnately parted with narrow segments, petiolate; cauline leaves similar or  $\pm$  reduced; stem elongate,  $\pm$  branched, aggregate inflorescence paniculate or corymbiform; heads small or medium, 7- to 18-flowered; outer involucre bracts  $\frac{1}{9}$  to  $\frac{1}{3}$  as long as the inner; corolla 8 to 22 mm long, mostly over 10 mm; achenes various as to color in different species, ranging from dark brown, purplish, or blackish to light brown or reddish, yellowish, or greenish brown, rather small, 2.5 to 5 mm long, in most species less than 4.5 mm, compressed or subcompressed,  $\pm$  attenuate or shortly beaked, 12- to 15-ribbed; pappus white, pale brown, or inky gray, rarely tinged with yellow, 3.5 to 9 mm long, 1- to 2-seriate, persistent. Type species: *Y. paleacea* (Diels).

SECTION 6. **Euyoungia.** Annual, biennial, or perennial herbs; plant pubescent or glabrous; caudex slender, in perennial species bearing strong fibers or prolonged into a slender woody root;  $\pm$  leafy; caudical leaves petiolate, entire or lyrate-pinnatifid or compound; cauline leaves similar, gradually reduced, or all reduced and bractlike; stem tall and branched above, or short and divaricately branched, or stems several, low, slender, few-headed, aggregate inflorescence cymose or cymose-corymbiform; heads small or very small, 10- to 25-flowered; outer involucre bracts  $\frac{1}{12}$  to  $\frac{1}{3}$  as long as the inner; corolla rarely over 10 mm long; achenes brown, purple, or red, very small, never over 3.5 mm long, in most species less than 3 mm, compressed,  $\pm$  attenuate or shortly beaked, 11- to 15-ribbed; pappus white, 1.5 to 4 mm long, mostly 1-seriate, persistent, deciduous, or caducous. Type species: *Y. japonica* (L.) DC.

### ARTIFICIAL KEY TO THE SPECIES

- A. Tufted alpine plants; stem absent or very short; heads borne among the caudical leaves or slightly above them.
  - B. Involucre 12 to 16 mm long; pappus 10 to 12 mm long.
    - C. Outer involucre bracts 5 to 7, nearly equal; style-branches brown or black *in sic.*; achenes attenuate, shortly and coarsely beaked; leaves rotund or ovate, the margins undulate or shallowly dentate. . . . . 1. *Y. depressa* (p. 33)
    - C. Outer involucre bracts about 12, unequal; style-branches yellow; achenes columnar, not beaked; leaves narrowly elliptic or oblanceolate, occasionally lobed or pinnatifid. . . . . 4. *Y. simulatrix* (p. 39)
  - B. Involucre 9 to 11 mm long; pappus 5 to 7 mm long.
    - D. Peduncles densely white-tomentose; outer involucre bracts  $\frac{1}{3}$  to  $\frac{2}{3}$  the length of the inner; inner bracts with narrow scarious margins and strongly ciliate apices, densely pubescent on the inner face; corolla 15 to 17 mm long; the tube pubescent. . . . . 2. *Y. parva* (p. 35)



- D. Peduncles sparsely tomentulose; outer involucre bracts  $\frac{1}{5}$  to  $\frac{1}{3}$  the length of the inner; inner bracts with broad scarious margins, sparsely or not at all ciliate at the apex, glabrous within; corolla 13 to 15 mm long; the tube glabrous... 5. *Y. gracilipes* (p. 40)
- A. Plant not tufted; heads elevated on stems 8 cm or more high.
- E. Heads 5-flowered; achenes truncate or very slightly attenuate upward, strongly attenuate downward; pappus-bristles united at base into a very narrow ring... 7. *Y. scaposa* (p. 45)
- E. Heads 9- to 30-flowered; achenes fusiform,  $\pm$  attenuate to both ends; pappus-bristles never united into a ring at base.
- F. Pappus ashy or inky gray; cauline leaves well developed, sinuate or coarsely dentate, but not pinnatifid or pinnate, and not spathose-subamplexicaul.
- G. Plant robust; middle cauline leaves 7 to 15 cm long, 1.5 to 4.5 cm wide; inner involucre bracts not crested; style-branches yellow... 9. *Y. cineripappa* (p. 60)
- G. Plant slender; middle cauline leaves 3 to 8 cm long, 0.8 to 2 cm wide; at least some of the inner involucre bracts tuberculate or crested; style-branches brown or green.... 11. *Y. gracilis* (p. 65)
- F. Pappus white, yellowish, or brownish; cauline leaves much reduced, or if well developed, either pinnatifid or pinnate, or spathose-subamplexicaul.
- H. Pappus yellow, the bristles coarse and brittle; inner involucre bracts 10 to 12; heads 10- to 17-flowered... 27. *Y. silhetensis* (p. 104)
- H. Pappus white or rarely yellow and then the bristles comparatively fine and soft and the inner involucre bracts about 8.
- I. Stems 8 to 15 cm high; peduncles  $\pm$  tomentose or tomentulose; inner involucre bracts 10 to 12, the apex plane.
- J. Stem elongate, remotely branched from base to summit; branches (at least the upper) corymbiform, pedunculate or rarely 2-headed; heads 13- to 18-flowered; outer involucre bracts  $\frac{1}{3}$  to  $\frac{1}{2}$  as long as inner; inner bracts densely pubescent on inner face... 3. *Y. conjunctiva* (p. 37)
- J. Stem short, closely branched; branches divaricate, pedunculate or 1- to 2-furcate; heads 20- to 30-flowered; outer involucre bracts  $\frac{1}{5}$  to  $\frac{1}{3}$  as long as inner; inner bracts glabrous on inner face... 5. *Y. gracilipes* (p. 40)
- I. Stems 10 to 100 or more cm high; peduncles glabrous; inner involucre bracts 6 to 8, or if more numerous, the apex strongly tuberculate or clawed.
- K. Stems arising from a stout woody caudex, often caespitose; caudical leaves completely glabrous, pinnatifid or pinnate with lanceolate, linear, or filiform segments; involucre bracts usually scabrous or pubescent; all of the inner and at least some of the outer with a crest or claw... 8. *Y. tenuifolia* (p. 46)

- K. Stems 1 to 2 from a slender, sometimes stoloniferous caudex, or annual with fibrous roots; leaves various; involucre bracts strictly glabrous, or ciliate at the tips, the inner plane, tuberculate, or clawed, the outer plane (if rarely crested or tuberculate, the leaves pubescent and with broadly triangular lobes).
- L. Plants strictly glabrous and glaucous; basal leaves entire or remotely denticulate; cauline leaves similar but gradually reduced, spathose at the subamplexicaul base; aggregate inflorescence a congested, racemiform panicle with fastigiate branches... 6. *Y. stenoma* (p. 42)
- L. Plants glabrous or pubescent, not glaucous; basal leaves truncate or cordate at the base, or the margins sinuate, dentate, or variously lobed or divided; aggregate inflorescence open, paniculate, corymbiform, or cymose.
- M. Inflorescence relatively simple, the lateral branches bearing 2 to 15 heads on relatively stout peduncles 8 to 45 (averaging 15 to 20) cm long; achenes 2.5 to 4 mm long; involucre 6 to 13 (averaging 7 to 9) mm long, the inner bracts either plane, swollen, or crested near the apex.
- N. Later caudical and cauline leaves pinnatifid with narrowly deltoid, lanceolate, or linear segments; inner bracts not swollen dorsally or tuberculate near the tips.
- O. Stem with only 1 to 2 well-developed leaves, the others linear and bract-like; caudical leaves 1.5 cm broad; inner involucre bracts glabrous on the inner face; achenes about 15-ribbed..... 16. *Y. Wilsoni* (p. 79)
- O. Stem with 2 to 7 well-developed leaves; caudical leaves 2 cm broad; inner involucre bracts pubescent on the inner face; achenes about 12-ribbed.
- P. Leaves thin and flaccid; segments of the caudical and lower cauline leaves bearing 1 to 2 prominent triangular teeth or lobes on the lower side; inflorescence confined to the upper half of the stem;

- involucres yellowish green in color; outer bracts narrowly deltoid, the longest 1.2 to 2.5 mm long; achenes 3 to 3.5 mm long; pappus pure white..... 18. *Y. Henryi* (p. 83)
    - P. Leaves thicker, not flaccid, the caudical with deltoid, the cauline with lanceolate entire segments; inflorescence occupying  $\frac{2}{3}$  of the entire length of the stem; involucres dark green or lead color; the outer bracts broadly deltoid, 1 to 1.5 mm long; achenes 2.5 to 3 mm long; pappus cream color..... 17. *Y. Pratti* (p. 81)
  - N. Later caudical and cauline leaves entire or with broadly triangular or suborbicular segments; inner involucre bracts swollen dorsally near the tip or crested, tuberculate, or corniculate.
    - Q. Caudical leaves long-petiolate, ovate, entire or with 2 to 4 lateral segments; plant glabrous..... 19. *Y. terminalis* (p. 85)
    - Q. Caudical leaves sessile or short-petiolate, attenuate at the base, the margin sinuate, lobed, or pinnatifid; plant pubescent or glabrous.
      - R. Plant glabrous or puberulent; pappus pale yellow or brownish... 10. *Y. fuscipappa* (p. 63)
      - R. Plant more or less pubescent; pappus white or yellowish at the base.
        - S. Inflorescence a 2- to 4-headed dichotomous cyme; involucres 6 to 7 mm high; pappus-bristles very unequal, 1.5 to 2.5 mm long on the mature achenes..... 21. *Y. bifurcata* (p. 89)
        - S. Inflorescence paniculate or corymbose, 4- to many-headed; involucres 6 to 12 mm high; pappus-bristles nearly equal, 3 to 9 mm long on the mature achenes.



- T. Involucre 9 to 13 mm long; corolla 12 to 22 mm long; pappus on mature achenes 6 to 9 mm long. 12. *Y. paleacea* (p. 67)
- T. Involucre 6 to 7 mm long; corolla 8 to 11 mm long; pappus on mature achenes 5 to 5.5 mm long.
- U. Outer involucral bracts 1 to 1.5 mm long; achenes 3 to 3.5 mm long; pappus 2-seriate.
- V. Inflorescence bearing 4 to 9 heads; pappus at anthesis 3 to 3.5 mm, on the mature achenes 4 to 4.5 mm long; achenes attenuate at the summit. 13. *Y. lanata* (p. 74)
- V. Inflorescence bearing 12 to 25 heads; pappus at flowering time 4 to 4.5 mm, on the mature fruit 5 mm long; achenes merely constricted at the summit.. 14. *Y. fusca* (p. 76)
- U. Outer involucral bracts about 0.75 mm long; achenes 2.5 mm long; pappus 1-seriate..... 15. *Y. Mairei* (p. 77)
- M. Inflorescence mostly large and compound, the lateral branches in well-developed plants bearing 5 to 30 heads on slender or filiform peduncles 2 to 15 (averaging 4 to 8) cm long; achenes 1.5 to 2.8 mm long; involucre 4 to 7 mm high, the inner bracts all strictly plane near the apex.

- W. Leaves hastate-cordate, simple, long-petioled; mature achenes light red, mottled with yellow..... 23. *Y. longipes* (p. 92)
- W. Leaves not hastate-cordate, all except rarely the lower caudical lobed or divided, and with petioles much shorter than the blade, or sessile; mature achenes brown or purplish, neither light red nor mottled.
- X. Plants very tall, 1 m high or more; cauline leaves numerous, bipinnatifid, the lateral segments pinnatifid or pinnate, and as broad as the terminal one; heads 21- to 25-flowered; achenes 2 to 2.3 mm long. 22. *Y. Rosthornii* (p. 92)
- X. Plants mostly less than 1 m high; cauline leaves, if present, lobed, pinnatifid, or pinnate, the lateral segments if present merely toothed and narrower than the terminal segment; heads 10- to 20-flowered.
- Y. Plants biennial or perennial; cauline leaves pinnatifid, the lateral segments ovate or elliptic, the terminal long-acuminate; involucre 5.5 to 7.5 mm high; achenes 2.2 to 2.8 mm long..... 20. *Y. heterophylla* (p. 87)
- Y. Plants annual; cauline leaves much reduced and entire or merely lobed, or if occasionally well developed and pinnatifid, the lateral segments triangular or rhomboidal, and the terminal obtuse, acute, or short-acuminate; involucre 4 to 7 mm but mostly less than 6 mm high; achenes 1.5 to 2.4 mm long.
- Z. Achenes, when fully mature, purplish, brownish, or brownish red, abruptly contracted at the apex or sharply tapering from above the middle to a short neck; pappus persistent..... 24. *Y. japonica* (p. 94)

- Z. Achenes, when fully mature, dull scarlet or yellowish red, tapering from about the middle to a definite short beak; pappus deciduous.
- &. Lower leaves with the terminal segment caudate, acutely 2-lobed and 1 to 2 cm wide at base; corolla 9 to 10 mm long; pappus on the mature achenes 3.5 mm long..... 25. *Y. rubida* (p. 100)
- &. Lower leaves with the terminal segment triangular or obscurely 2-lobed and 2 to 3 cm wide at base; corolla 6 mm long; pappus on the mature achenes 2.5 mm long..... 26. *Y. erythrocarpa* (p. 102)



## SECTION 1. DESIPHYLUM

### RELATIONSHIPS OF THE SPECIES

The five species of this section are alpine perennials of very low stature. They occur at elevations of from 3000 to 5000 meters in the mountains of western China, Tibet, and northern India. All except *Y. conjunctiva* are tufted in habit, with the short peduncles congested among the leaves. One of these tufted species, *Y. depressa*, is unique in its combination of morphological characters which suggest affinity with other genera (cf. p. 16). It is not closely related to the other species of this section. Nearly as outstanding, but somewhat less primitive on the whole, is *Y. parva*, which has unusually long outer involucral bracts and densely tomentose peduncles. These, together with the short, paniculately branched stem, and the form and texture of the leaves, reveal its close affinity with *Y. conjunctiva*. The other two species, *Y. simulatrix* and *Y. gracilipes*, although not very close, show more resemblance to each other than to the other species of this section. In *simulatrix* the heads, involucral bracts, and pappus-bristles are somewhat larger than those of *depressa*, but the achenes are shorter and unequally ribbed as in other *Youngia* species. The much smaller heads, bracts, and pappus-bristles in *gracilipes* are associated with a higher number of florets per head. These species may be arranged in the following order: *depressa*, *parva*, *conjunctiva*, *simulatrix*, *gracilipes*; but this arrangement is not intended to represent a phylogenetic series. The five species may represent three different lines: (1) *depressa*, (2) *parva* and *conjunctiva*, and (3) *simulatrix* and *gracilipes*, which developed from one or more progenial stocks.

#### 1. *Youngia depressa* (Hook. f. et Thoms.) comb. nov. (Fig. 2)

Perennial, tufted, 2 to 3 cm high, rosette 10 to 20 cm across; caudex vertical, 3 to 6 mm wide, prolonged into a strong taproot, crown woody, stemless, bearing many short-peduncled heads; leaves up to 10 cm long, 3 cm wide, rather fleshy, rotund or ovate, obtuse, obscurely denticulate or dentate, base rounded, 5-nerved from near base, petiole stout, longer, equal to, or shorter than blade, puberulent on upper side and petiole; peduncles 5 to 12 mm long, bracteate near base, pubescent; heads medium, numerous, congested, about 15-flowered; involucre cylindric, 13 to 16 mm high, 3 to 5 mm wide in anthesis,  $\pm$  pubescent with stout yellowish or purplish eglandulose setiform hairs; outer involucral bracts 5 to 7, nearly equal, about  $\frac{1}{4}$  as long as inner ones, lanceolate or linear, acute; inner bracts 7 or 8, in 2 series, lanceolate, acute, ciliate at tip, innermost broadly scarious-margined, becoming dorsally keeled and spongy-thickened near base, ventrally glabrous; receptacle areolate-fimbriate, areolæ 0.4 mm wide, fimbriæ 0.25 to 0.35 mm high, naked; corolla 14 to 17 mm long; ligule 0.8 to 1.0 mm wide; teeth 0.3 to 0.5, 0.8 mm long, acute, obtuse, or truncate, conspicuously crested and hooded with glanduliferous

apical anterior protuberance; corolla-tube 4 to 8 mm long, glabrous; anther-tube greenish,  $2.5 \times 1$  mm dis.; filaments slender, long, extending beyond appendages about 2 mm; appendages 0.5 mm long, lanceolate, acute, mostly free; style-branches 1.25 mm long, 0.1 mm wide, attenuate at tip, brown or black *in sic.*; achenes yellow mottled with brownish purple, 6 to 7 mm long, 0.5 to 0.75 mm wide, mostly strongly compressed or 3-angled, strongly attenuate into a short coarse yellow beak, with

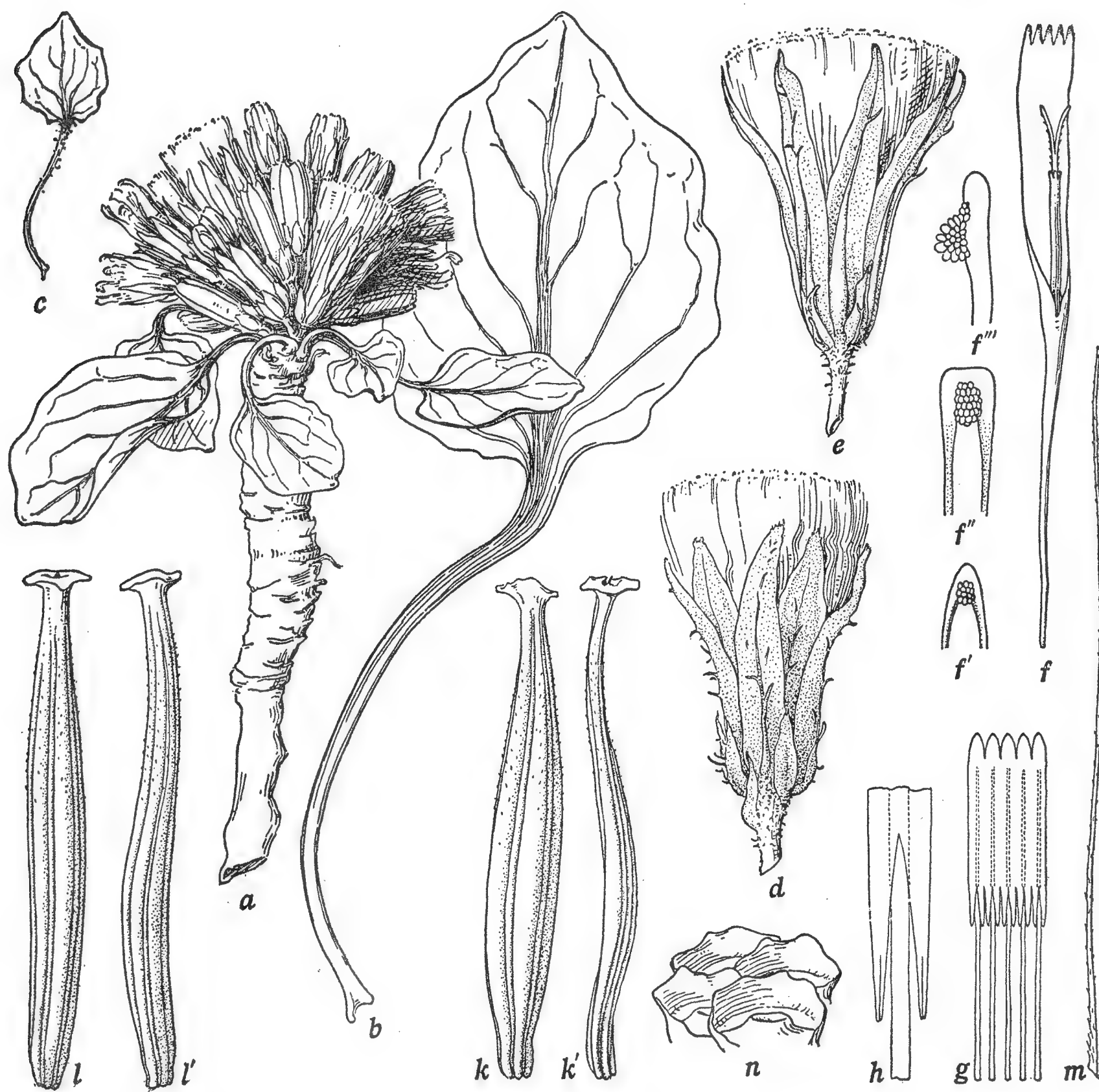


FIG. 2—*Youngia depressa*, from type collection (K): a, plant,  $\times \frac{1}{2}$ ; b, c, leaves showing range in size,  $\times 1$ ; d, e, heads showing variations in degree of pubescence and of dorsal thickening on the inner bracts,  $\times 2$ ; f, corolla,  $\times 4$ ; f', f'', middle and intermediate ligule-teeth, inner face, f''', marginal tooth, side view,  $\times 25$ ; g, anther-tube,  $\times 8$ ; h, detail of appendages,  $\times 32$ ; k, k', dorsal and lateral views of a marginal achene,  $\times 8$ ; l, l', similar views of an inner achene,  $\times 8$ ; m, a pappus-bristle,  $\times 8$ ; n, detail of receptacle,  $\times 20$ .

pappus-disk as wide as the achene, constricted at the hollow yellow-calloused base, 10- to 12-ribbed, ribs unequal, mostly alternately wide and narrow, rounded, finely spiculate above; pappus yellowish white or yellow, 10 mm long, 2-seriate, rather coarse, stiff and brittle, persistent, coming away singly or in clumps. Flowering September to October; flowers yellow, anthers green, style black or brown *in sic.* Chromosomes,  $2n = 16$ . (*Crepis glomerata* Clarke, Comp. Ind. 255, 1876, excl. syn.,

non Dcne.; *Crepis depressa* Hook. f. et Thoms., Fl. Brit. Ind. 3:397, 1882.)

Eastern Himalaya Mountains, Sikkim and Tibet, 4500 to 5000 m alt. Type collection at Kew, cotypes at Berlin and in Herb. De Lessert.

SIKKIM: 4500 to 5000 m alt., *J. D. Hooker* in September, October, 1849 (K, B, DL); Sebu Valley, 4646 m alt., *Gammie* in 1892 (K). TIBET: Yatung, 27°51'N., 88°35'E., *Hobson* in 1897 (K); Chumbi, *Dr. King's collector* 404 (K).

#### RELATIONSHIP

Although the strongly congested flower-heads are reminiscent of *Crepis nana* and the leaves resemble those of *C. Umbrella*, yet the compressed or angular, unequally ribbed achenes indicate closest affinity with *Youngia*. But this species is not closely related to the other tufted species of this genus (cf. p. 33). The longer, coarsely beaked achenes with alternate wide and narrow ribs and the coarse, yellowish pappus suggest affinity with *Dubyæa hispida*, a primitive cichoriaceous species.

#### 2. *Youngia parva* sp. nov. (Fig. 3)

Herba perennis, valde humilis; caudex rectus, ligneus, foliosus; folia parva, oblanceolata; cauliculus brevissimus, dense tomentosus, canus, breviter ramosus, rami cum 1–2 capitulis; capitula pauca, 15-flora; involucre viridissimum; squamæ externæ longæ; receptaculum glabratum; germina fusca, ad apicem constricta, cum costis inæqualibus; corolla circa 17 mm longa, flava; antheræ 5 mm longæ, virides; pappus 7 mm longus, crassiusculus, mollis.

Perennial, low, tufted, up to 4 cm high, 5 cm wide; caudex vertical, woody, up to 2 cm long, 3 mm wide, prolonged into a strong taproot, leafy at crown; caudical leaves ascending, up to 3.5 cm long, 9 mm wide, oblanceolate, obtuse or acute, sinuately to runcinately dentate or pinnatifid, attenuate into a winged petiole equal to or shorter than blade, bright green above, purple at the retrorsely revolute margin, pale beneath, canescent-tomentose or glabrescent; stem 1 to 1.5 cm high, erect, densely canescent-tomentose, paniculately branched, branches very short, 1- to 2-headed; peduncles up to 1 cm long, densely canescent-tomentose; heads 4 to 7, erect, medium, about 15-flowered; involucre cylindric-campanulate, 10 to 11 mm high, 4 to 5 mm wide before anthesis, very dark green; outer involucral bracts 6 to 8, unequal, longest  $\frac{1}{3}$  to  $\frac{1}{2}$  or even  $\frac{2}{3}$  as long as inner bracts, lanceolate, acute, white ciliate at tip, glabrous on both sides; inner bracts about 10, lanceolate, acute or obtuse, white- or yellow-ciliate at tip, densely pubescent on inner face with appressed shining hairs, glabrous dorsally, with a median nerve, brownish near base in anthesis; receptacle areolate, naked; ovary brown, 1 mm long, constricted at summit, with slightly expanded pappus-disk, unequally ribbed; corolla 15 to 17 mm long, ligule about 2.5 mm wide; teeth 0.5 to 0.75 mm long, conspicuously gland-crested, hooded; corolla-tube 3.5 mm long, stout, pubescent with strong brown acicular hairs up to 0.18 mm long; anther-tube  $5 \times 1.25$  mm dis.; filaments long, extending beyond appendages 1.75 mm; appendages 0.6 mm long, oblong, obliquely acute, united; style-branches 2.5 mm long, 0.15 mm wide, slightly attenuate to the



rounded tip, yellow; achenes lacking; pappus white, 7 mm long, 2-seriate, united at base, coming away in clumps, rather coarse, soft, barbellulate. Flowers yellow, anthers yellow and greenish at summit *in sic.*, style yellow.

Known only from the type locality. Collected August 10, 1922, with flowers but no fruits.

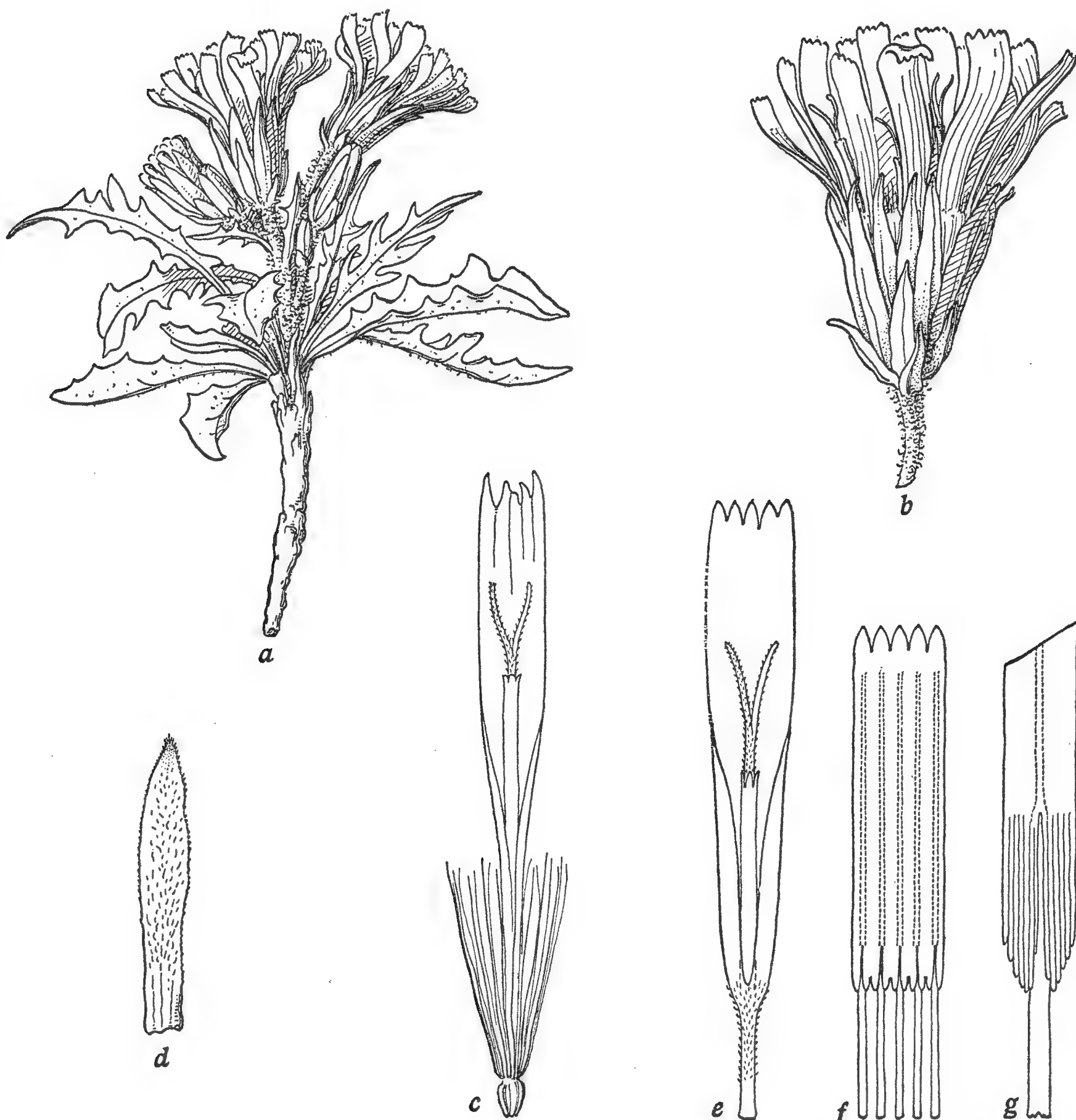


FIG. 3—*Youngia parva*, from type (Upsala): *a*, plant,  $\times 1$ ; *b*, flowering head,  $\times 2$ ; *c*, floret,  $\times 4$ ; *d*, inner involucre bract, inner face,  $\times 4$ ; *e*, floret lacking ovary,  $\times 4$ ; *f*, anther-tube,  $\times 8$ ; *g*, detail of appendages,  $\times 32$ .

CHINA: northern Szechwan, Sanchá-trü, precipice, 4300 to 4500 m alt., Harry Smith 3218 (Upsala).

#### RELATIONSHIP

Although achenes are lacking in the type collection, there can be no doubt that this distinct species is related to the other tufted perennial species of *Youngia*. It is probably near *Y. gracilipes* or *Y. simulatrix*, but it differs in the heavy tomentum on stem and peduncles, the very

unequal outer involueral bracts, the dense pubescence on inner face of inner involueral bracts, the type of pubescence on the short stout corolla-tube, the peculiar anther-appendages, and in other details. In some of these features *Y. parva* also shows affinity with *Y. conjunctiva*.

### 3. *Youngia conjunctiva* sp. nov. (Fig. 4)

Herba perennis, 10–15 cm alta; caudex rectus, ligneus, foliosus; folia caudicalia brevia, angusta, oblanceolata, tomentulosa; folia caulina acuminata vel linearia; caulis fistulosus, multiramosus, paniculatus, in formam corymbi, rami cum 1 vel 2 capitulis; pedunculi dense tomentosi; capitula media, 13–18-flora; involucrium viridissimum, glabratum; squamæ externæ longæ; receptaculum glabratum; corolla circa 16 mm longa, flava; antheræ 5 mm longæ, virides; achænia parva, fusca, forte attenuata, paululum compressa, cum costis inæqualibus; pappus albus, inæqualis, persistens.

Perennial, 8 to 12 cm high; caudex vertical, woody, brown with bases of old leaves, up to 15 mm long, 6 mm wide, prolonged into a very slender taproot, leafy at crown; caudical leaves ascending, up to 6 cm long, 1.2 cm wide, oblanceolate, obtuse or acute, sinuately dentate or runcinate-pinnatifid, attenuate into a short, broadly winged petiole, margin narrowly retrorsely revolute, sparsely canescent-tomentulose on both sides with long many-celled piliform trichomes; cauline leaves similar but acuminate, lateral segments narrow, salient, acuminate, uppermost linear or bractlike; stem stramineous, erect, terete, striate, fistulose, canescent-tomentulose, paniculately branched from base to summit, lower branches elongate,  $\frac{1}{2}$  as long as stem or sometimes lacking, upper branches shorter, the uppermost 4 or 5 in a corymbiform cluster, pedunculate or rarely 2-headed; peduncles densely canescent- or fuscous-tomentulose near head with many-celled trichomes as on leaves; heads erect, medium, 13- to 18-flowered; involucre cylindric-campanulate, 10 to 11 mm long, 4 mm wide at middle in anthesis, very dark green; outer involueral bracts 6 to 8, unequal, longest  $\frac{1}{3}$  to  $\frac{1}{2}$  as long as inner bracts, lanceolate, acute, white-ciliate at tip, glabrous on both sides; inner bracts 10 to 12, lanceolate, acute, white- or yellow-ciliate at tip, densely pubescent on inner face with appressed yellow shining hairs, dorsally glabrous with darker median nerve, becoming brown at base and slightly carinate in young fruiting heads; receptacle areolate, naked; corolla about 16 mm long; ligule 1.5 mm wide; teeth 0.4 to 0.6 mm long, conspicuously gland-crested, hooded with small apical anterior protuberance; corolla-tube about 5 mm long, glabrous except a few stout nearly cylindric hyaline hairs up to 0.15 mm long; anther-tube  $5 \times 1.3$  mm dis.; filaments extend beyond appendages 1 mm; appendages about 0.75 mm long, oblong, acute, united; style-branches 2.25 mm long, 0.15 mm wide, semicylindric, obtuse, yellow; achenes (immature) dark brown, about 2 mm long, 0.75 mm wide, compressed, fusiform, strongly attenuate to the narrow (0.3 mm wide) summit, with expanded pappus-disk, constricted at the calloused hollow base, 12-ribbed, ribs unequal, 3 to 5 stronger, finely spiculate; pappus white, brownish at base, about 7 mm long, 2-seriate, united at base, coming away in clumps, unequal in length and coarseness, some

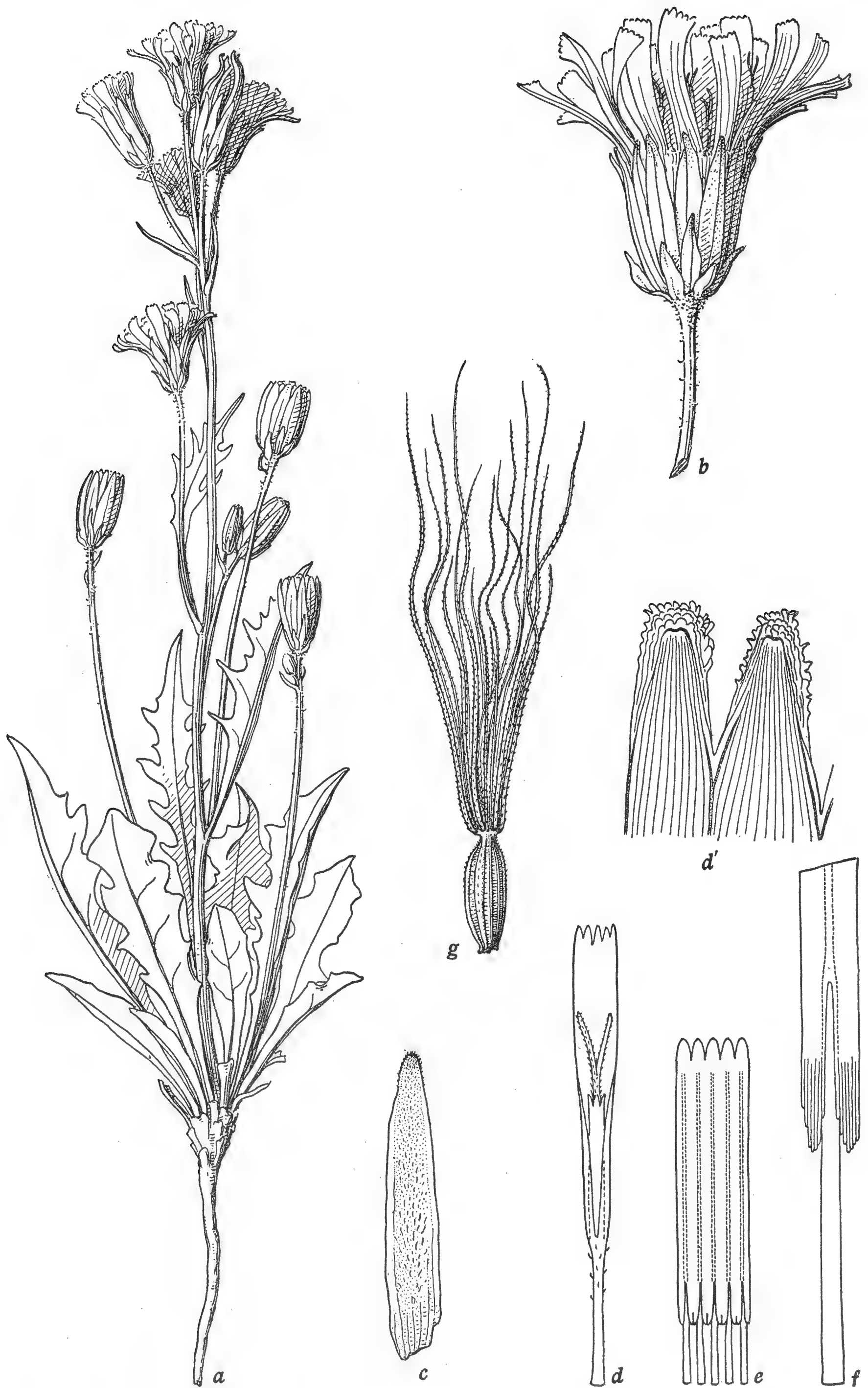


FIG. 4—*Youngia conjunctiva*, from type (UC 489434): *a*, plant,  $\times 1$ ; *b*, flowering head,  $\times 2$ ; *c*, inner involucre bract, inner face,  $\times 4$ ; *d*, floret lacking ovary,  $\times 4$ ; *d'*, detail of ligule-teeth,  $\times 50$ ; *e*, anther-tube,  $\times 8$ ; *f*, detail of appendages,  $\times 32$ ; *g*, young achene with pappus,  $\times 8$ .



bristles much stronger, soft, barbellulate, persistent. Flowers yellow, anthers green, style yellow.

Known only from the type locality. Collected July to August, 1925, with flowers and young fruits.

CHINA: southwestern Kansu, upper Tebbu region, "grassy slopes at foot of Shimen," 3636 m alt., *Rock 13062* (UC 489434 *type*, B cotype).

#### RELATIONSHIP

Closest to *Y. parva*, from which it differs strikingly in its habit.—In this respect it approaches *Y. Wilsoni* and *Y. fusca* of section *Mesomeris* and through them shows a connection with section *Euyoungia*. But its closest affinity is with the tufted perennials in size and habit of the plant, in the tomentose peduncles, and in floral characters.

#### 4. *Youngia simulatrix* (Babcock) comb. nov. (Fig. 5)

Low tufted perennial; caudex slender, vertical, simple or 1-branched, covered with brown bases of old leaves; leaves rosulate, up to 6 cm long,

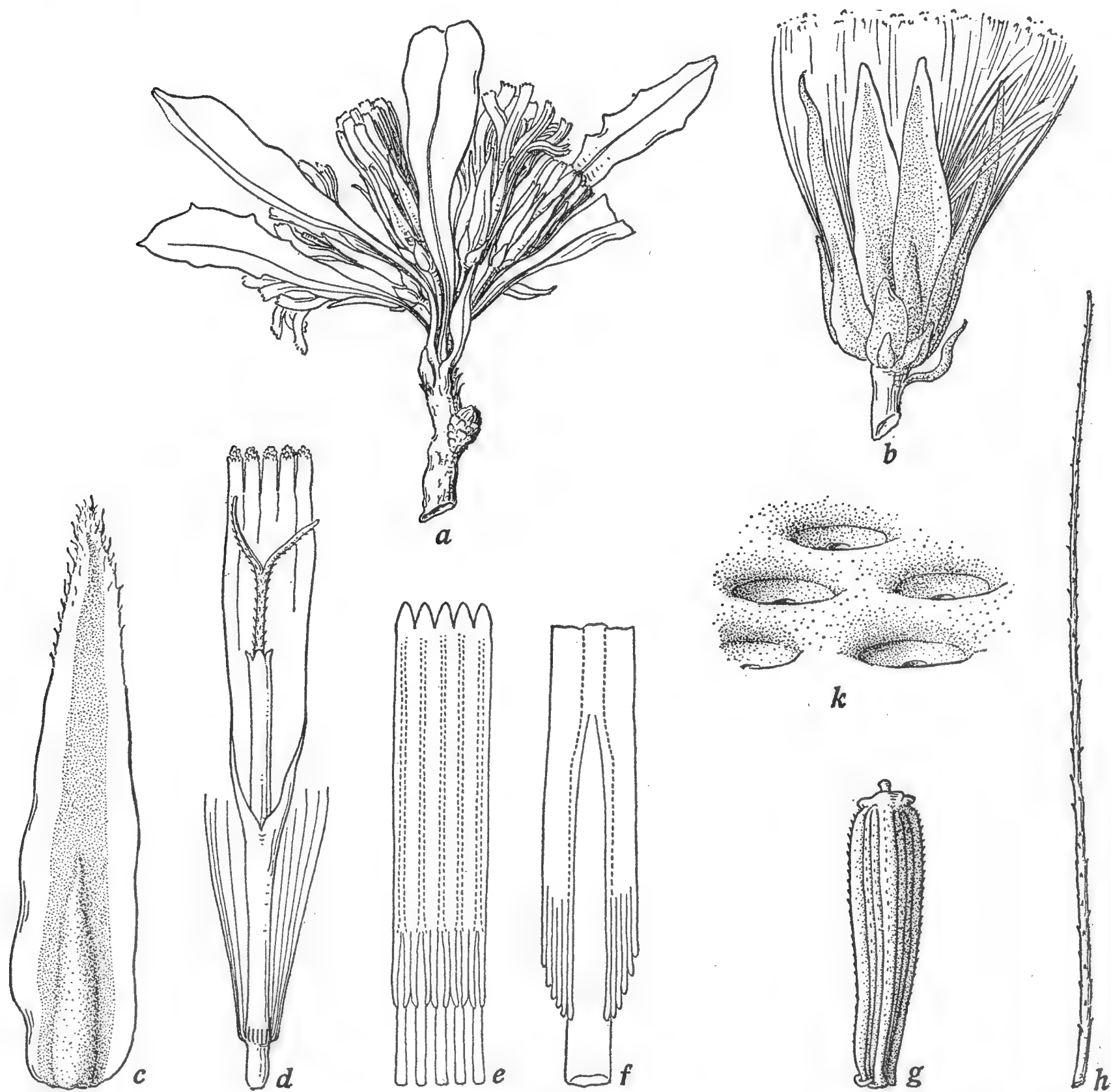


FIG. 5—*Youngia simulatrix*, from type (BB) and cotypes: *a*, plant,  $\times 1$ ; *b*, mature head,  $\times 2$ ; *c*, inner involucre bract, dorsal,  $\times 4$ ; *d*, floret,  $\times 4$ ; *e*, anther-tube,  $\times 8$ ; *f*, detail of appendages,  $\times 32$ ; *g*, *h*, achene and pappus-bristle,  $\times 8$ ; *k*, detail of receptacle,  $\times 25$ .

1.2 cm wide, oblanceolate, obtuse, sinuately denticulate, dentate, sub-runcinate, or runcinate with obtuse segments, tapering into a short winged petiole, with prominent pale midrib, glabrous or puberulent on upper side,  $\pm$  hispidulous beneath; stem bearing leaves of the season about 1 cm long, branched at the top, branches very short, pedunculate; peduncles rather stout and like involucre glabrous; heads 4 to 7, erect in a close cluster, 15- to 20-flowered; involucre 12 to 16 mm high, 3 to 5 mm wide at base, cylindric; outer involucral bracts about 12, unequal, longest less than  $\frac{1}{2}$  as long as inner ones, ovate-triangular or lanceolate, green or outermost scarious, becoming lax; inner bracts 8 to 12, lanceolate, acute or obtuse, with wide scarious margins, becoming prominently spongy-thickened dorsally near base, glabrous within; receptacle areolate, areolæ circular, 0.4 to 0.5 mm wide, interspaces elevated, rounded, glabrous; corolla about 17 mm long; ligule about 2 mm wide; teeth about 1 mm long, oblong, obtuse, thickened at glanduliferous tip; corolla-tube about 5 mm long, glabrous; anther-tube yellow below, greenish above, about  $4.6 \times 1.3$  mm dis.; appendages about 1 mm long, oblong, obliquely acute; style-branches 2 mm long, yellow; achenes dark brown, 3.5 to 4 mm high (not fully mature), compressed or 4-angled, columnar, narrowed slightly toward the calloused base, constricted at summit below the pale cup-shaped pappus-disk, 14- to 15-ribbed, ribs unequal, 4 to 5 stronger, strongly spiculate; pappus white, yellowish at base, 10 to 11 mm long, 3-seriate, coarse, thickened and strong at base, barbellulate above, persistent. Flowering August to November, flowers golden yellow, anthers greenish, style yellow. (*Crepis simulatrix* Babcock, in Univ. Calif. Publ. Bot. 14:329, 1928.)

Tibet and Sikkim, in sandy places, 3300 to 4850 m alt. Type specimen in Herb. Barbey-Boissier. Name suggested by J. R. Drummond in herb.

SOUTHERN TIBET: Ñalamla, sandy place, 4200 m alt. (type locality), *Gyatsko*, Dr. King's collector, in 1882 (BB, P, B, Calcutta); Mount Everest region, Raphu, 3500 m alt., *Morton* in 1922 (K); Mount Everest region, Phung Clin (Arun) Valley, 3300 m alt., *Morton* in 1922 (K); Mount Everest, 4242 m alt., *Wollaston* 148 (K). SIKKIM: Tu Le, 4850 m alt., *Lepeha* 2711 (Calcutta). NORTHERN TIBET: Tsodjaranor, *Filchner* 105 (B).

#### RELATIONSHIP

Although simulating *Y. depressa* in the tufted habit and large heads, this species is certainly more closely related to *Y. gracilipes*; but it is very distinct from both these species in its abundant, long, coarse pappus and columnar achenes. It is less close to *Y. parva*.

#### 5. *Youngia gracilipes* (Hook. f.) comb. nov. (Fig. 6)

Perennial, tufted, 2 to 5, 9, 15 cm high, rosette small, leaves ascending; caudex prolonged into a slender creeping rootstock, simple or branched, crown covered with brown bases of old petioles; leaves crowded on the short stem, or with 2 or 3 similar leaves borne above the rosette, oblanceolate, rarely obovate or spatulate, acute or obtuse, sinuately dentate or pinnately lobed, lobes obtuse or acute, entire or denticulate, shortly

pubescent on both sides, narrowly petiolate; stem short, slender, several-branched; peduncles filiform, 2 to 4 cm long, bracteate,  $\pm$  tomentose; heads erect, medium, 20- to 30-flowered; involucre cylindric, about 9 mm high, 4 mm wide in anthesis; outer involucral bracts about 10, unequal,  $\frac{1}{5}$  to  $\frac{1}{3}$  as long as inner ones; inner bracts 8 to 10, in 2 ranks with inner

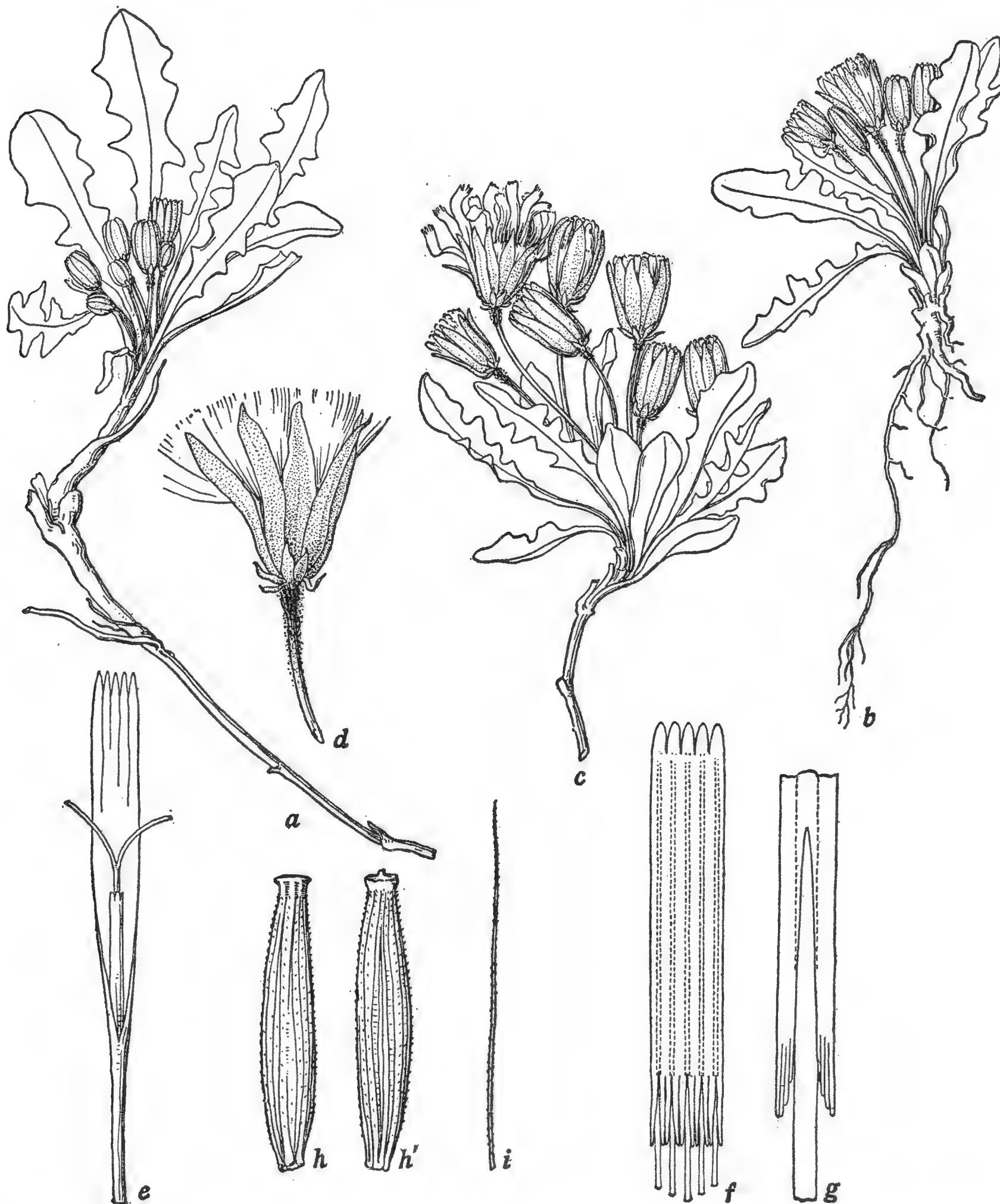


FIG. 6—*Youngia gracilipes*, *a-c*, from type collection (K); *d-g*, from *Duthie 5717* (UWG), form 2; *h-i*, from *Duthie 3090* (BM), form 1: *a*, *b*, *c*, plants,  $\times 1$ ; *d*, head,  $\times 2$ ; *e*, floret lacking ovary,  $\times 4$ ; *f*, anther-tube,  $\times 8$ ; *g*, detail of appendages,  $\times 32$ ; *h*, *h'*, *i*, achene and pappus-bristle,  $\times 8$ .

ones broadly membranous-margined, lanceolate, acute, glabrous on both sides, becoming dorsally keeled and thickened at base in mature fruiting heads; receptacle areolate, naked; in form 2 corolla 13 to 15 mm long; ligule about 1.75 mm wide; teeth 0.5 to 0.7 mm long, narrow, acute, purple-tipped; corolla-tube about 4.5 mm long, glabrous; anther-tube



5 to 6  $\times$  1 mm dis.; filaments unequal, projecting beyond appendages 0.4 to 1.2 mm; appendages 1 mm long, narrow, sagittate, united; style-branches 2.25 mm long, 0.1 mm wide, acute at tip, yellow; achenes dark dull green with yellow summit and yellow or red pappus-disk in form 1, very dark brown in form 2, 4 mm long, subcompressed or angular, fusiform, about equally attenuate toward base and summit, 10- to 12-ribbed, ribs unequal, 3 to 5 stronger, spiculate; pappus white, 5 to 7 mm long, 2-seriate, strongly and thickly barbellulate, soft, persistent. Flowering August; flowers yellow with red on outer face of ligules (or suffused purplish?), stamens yellow or slightly greenish *in sic.*, style yellow. (*Crepis gracilipes* Hook. f., Fl. Brit. Ind. 3:396, 1882.)

Himalaya Mountains, from north central India to Sikkim and into Tibet, 3000 to 4600 m alt., on loose débris.

Unfortunately there are no achenes on the type sheet and only one head with florets, and these have not been examined in detail. The only other mature achenes seen by the authors are those of form 1. It is not known whether achenes of typical plants are like those of form 1 or form 2. For the present, therefore, it seems best to treat all these forms as one species. When future collections with both flowers and fruits are available it should be possible to determine more definitely the taxonomic entities involved in this assemblage.

SIKKIM: alpine region, *Hooker* in 1849 (K), *type*; *Tlouce*(?), 4600 m alt., *Smith and Cave* in 1909 (Calcutta). TIBET: Khamba Jong, *Younghusband* 109 (K); Gyantse, *Walton* in 1904 (K, Fl), form 1. NORTH CENTRAL INDIA: Kumaun, Nipchang Valley, 3600 to 4200 m alt., *Duthie* 3090 (K), typical, (BM), form 1; *ibid.*, Shinla, *Duthie* 24523 (K), form 1; *ibid.*, Nampa Gadh, loose débris, 3000 to 3300 m alt., *Duthie* 5717 (K, Fl, UWG, UWK), form 2.

#### NUMBERED FORMS

1. YOUNGIA GRACILIPES, but stem longer than in type; peduncles exceeding leaves. Probably this is merely a more robust form of the species. *Walton* in 1904 (K, Fl), Gyantse, Tibet; *Duthie* 3090 (BM), Kumaun, north central India. (Fig. 6, *h-i*.)
2. YOUNGIA GRACILIPES(?); plants 5 to 9 or even 15 cm high; leaves 2 or 3 times as long as in type; branches 1- to 2-furcate, leafy, filiform; heads borne well above the leaves; achenes dark brown, less attenuate at summit; pappus 6 to 7 mm long. This form may eventually be recognized as a subspecies or even a species. *Duthie* 5717 (K, Fl, UWG, UWK), Nampa Gadh, loose débris, 3000 to 3300 m alt., Kumaun, north central India. (Fig. 6, *d-g*.)

#### RELATIONSHIP

This species has as its nearest ally *Y. simulatrix*, but the two are very distinct in size of heads, size and shape of achenes, length of pappus, and details of the inflorescence. It is less close to *Y. depressa*, *Y. parva*, and *Y. conjunctiva*.

#### SECTION 2. STENOPHYTUM

6. *Youngia stenoma* (Turcz.) Ledeb., Fl. Ros. 837, 1844–1846.  
(Fig. 7)

Perennial, 20 to 50 cm high, glabrous; taproot long, woody, straight or curved, up to 6 mm wide at base of caudex; caudex up to 1 cm wide,

leafy; caudical leaves up to 12 cm long, 1 cm wide, lanc-linear, acute or obtuse, irregularly dentate or denticulate or entire, gradually attenuate into a winged petiole with broader clasping base, glaucescent, rather thick, fleshy, midrib prominent; cauline leaves numerous, similar but



FIG. 7—*Youngia stenoma*, a, from Turczaninow in 1831 (DC); b–f, i, from Turczaninow in 1831 (Fl); g, h, from Ikonnikov in 1931 (UC): a, plant,  $\times \frac{1}{2}$ ; b, young head,  $\times 2$ ; c, floret lacking ovary,  $\times 4$ ; c', detail of ligule-teeth,  $\times 50$ ; d, anther-tube,  $\times 8$ ; e, detail of appendages,  $\times 32$ ; f, fruiting head,  $\times 2$ ; g, h, i, marginal and inner achenes and pappus,  $\times 8$ .

gradually reduced upward, becoming sessile and acuminate,  $\pm$  spathose at the subamplexicaul base, in inflorescence bractlike; stem simple, erect, terete, striate, regularly and closely branched from middle to apex, branches short, fastigiate, 1- to 3-headed, aggregate inflorescence a panicle or raceme; peduncles 0.5 to 2 cm long, bracteate; heads erect, small, 9- to 11-flowered; involucre cylindric, 8 to 9 mm high, campanulate in fruit, glabrous; outer involucre bracts 5 to 6, unequal, longest  $\frac{1}{3}$  as long as inner bracts, lanceolate, acute; inner bracts 7 to 8, lanceolate, acute, ciliate at tip, scarious-margined, glabrous within, with median dorsal nerve often prominent toward apex, crested with a thin membranous wing or claw near tip, wing sometimes serrate, becoming dorsally keeled and somewhat spongy-thickened near base in fruit, ultimately reflexed; receptacle areolate, naked; corolla 12 mm long; ligule 1.5 mm wide; teeth 0.4 to 0.8 mm long, conspicuously gland-crested, hooded with anterior apical protuberance; corolla-tube 5 mm long, glabrous; anther-tube  $3.5 \times 1.2$  mm dis.; filaments extend beyond appendages 0.6 mm; appendages 0.4 mm long, lanceolate, acute, united; style-branches 1.25 mm long, 0.1 mm wide, attenuate at tip, yellow with black or green barbs; achenes greenish brown, 4.5 to 5 mm long, about 0.8 mm wide, subcompressed, gradually attenuate to the rather broad (0.3 to 0.5 mm) summit, with slightly expanded white pappus-disk, constricted near the very narrow finely calloused hollow base, 12- to 14-ribbed, ribs narrow, rounded, unequal, with 4 to 5 somewhat stronger, densely spiculate; pappus white, exceeding involucre, 2-seriate, unequal, 4 to 6 mm long on same achene, united at very base, soft, barbellulate, deciduous in a ring. Flowering June to July; flowers yellow, ligules with reddish-purple stripe on outer face, teeth purple. Basal leaves often over 20 cm long according to Ledebour. Chromosomes,  $2n=16$ . (*Crepis stenoma* Turcz., ex DC., Prod. 7:164, 1838; *Prenanthes spathulata* Turcz., ex Herd., in Bull. Soc. Nat. Mosc. 43(1):192, 1870.)

Outer Mongolia and southern Siberia, steppes and mountains, in alkali soils and sedge-covered hummocks of swamps.

SIBERIA: Transbaicalia, Mongolian border, near Lake Tarei (Suntorei?), *Turczaninow* in 1831 (DC), *type*; Nerchinsk region, *Turczaninow* in 1831 (Fl), as *Prenanthes spathulata*; Transbaicalia, *Turczaninow* in 1831 (K), as *Sonchus*. OUTER MONGOLIA: *Turczaninow* in 1831 (DC); Butün Steppe, Ulantologoi, *Potanin* in 1884 (B); Artsa Bogdo Mountains, *Chaney* 349 (UC).

#### RELATIONSHIP

Although not closely related to any other species of *Youngia*, this species falls naturally into this genus on the basis of both morphology and chromosomes. The habit is superficially like that of *Prenanthes racemifera*, but the heads are erect in *stenoma* and the inflorescence is a contracted panicle. The outer involucre bracts are more unequal than in most species of *Youngia*, but in other respects the involucre is typical and the crests on the inner bracts resemble those of *Y. paleacea* and other crested species. The florets are like those of *Youngia* or *Crepis* rather than *Prenanthes*, and the achenes are typical of *Youngia*. The reference of this species to *Sonchus* by Bentham and Hooker (Gen. Pl. 2 (1):515, 1873) cannot be accepted.

## SECTION 3. HIERACIELLA

7. *Youngia scaposa* (Chang) comb. nov. (Fig. 8)

Perennial, 25 to 30 cm high; caudex 1 to 2 cm long, 8 mm wide, woody, leafy at summit, brown-woolly at bases of leaves; caudical leaves up to 20 cm long, 7 cm wide, oblanceolate, obtuse, lyrate-pinnately parted, terminal segment 5 to 10 cm long, ovate, shallow-lobed, denticulate, lateral segments mostly alternate, close, rotund, denticulate, gradually reduced toward base, petiole short, broader at base, pubescent on both sides with short many-celled piliform eglandulose trichomes, brownish and crinkled *in sic.*, trichomes longer, coarser, and paler on midrib and petiole, distinct from brown wool of caudex; cauline leaves bractlike at

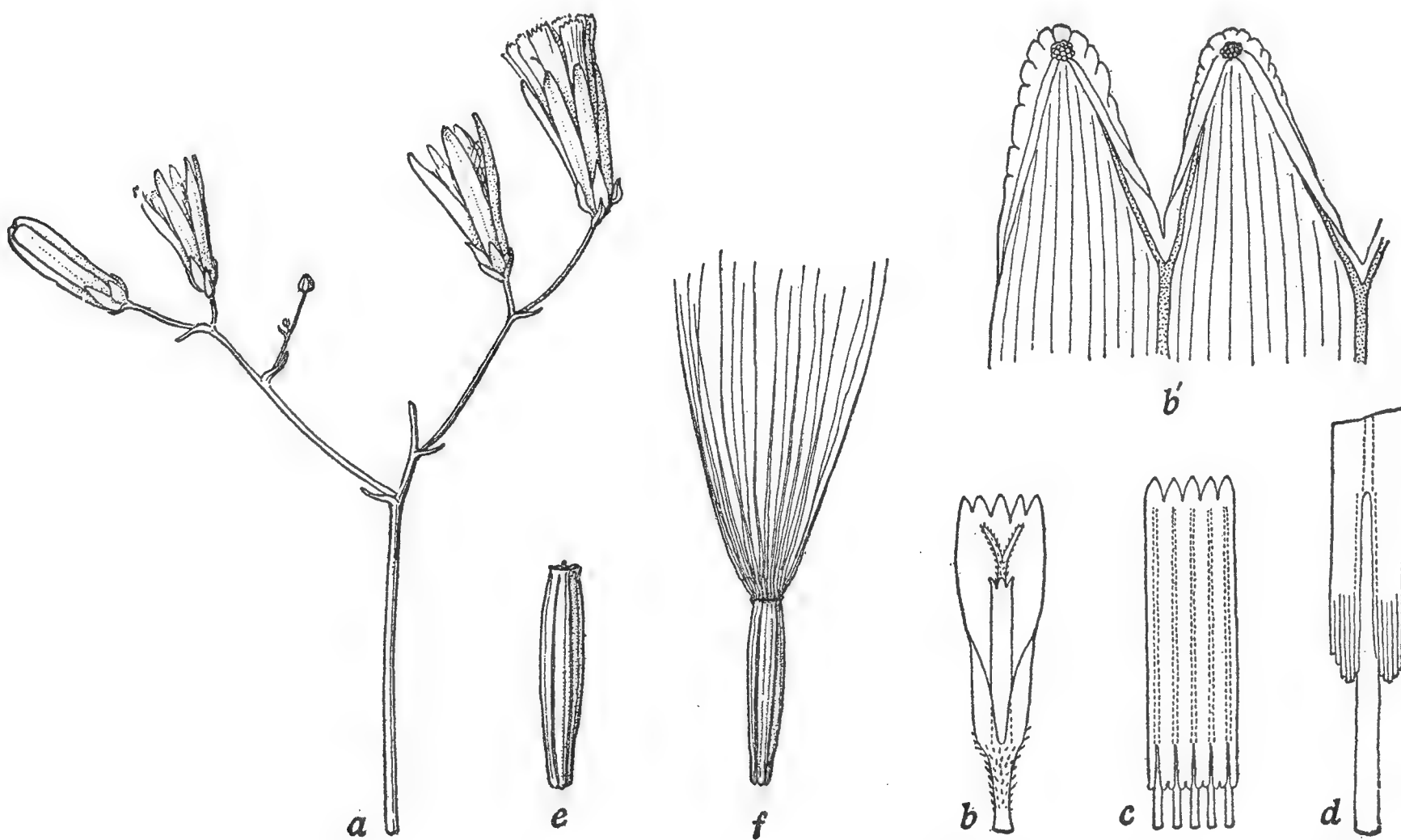


FIG. 8—*Youngia scaposa*, from cotype (B): a, small part of inflorescence showing 4 heads at different stages,  $\times 2$ ; b, floret lacking ovary,  $\times 4$ ; b', detail of ligule-teeth,  $\times 50$ ; c, anther-tube,  $\times 8$ ; d, detail of appendages,  $\times 32$ ; e, f, achenes,  $\times 8$ .

bifurcations of inflorescence; stem erect, slender, terete, striate, pubescent near base, glabrous above, remotely 4-branched from about middle upward, branches strict or arcuate, elongate, exceeding axis, cymosely compound, many-headed, aggregate inflorescence corymbiform; peduncles 0.5 to 6 mm long, very slender; heads erect, small, mostly 5-flowered; involucre cylindric-campanulate, 6 to 7 mm long, 1.5 mm wide at base, glabrous; outer involucre bracts 5 to 6, unequal, 0.5 to 1.5 mm long, lanceolate, acute; inner involucre bracts 5, lanceolate, obtuse, glabrous within, becoming broadly carinate and spongy-thickened near base in fruit; receptacle 1 mm wide, naked; corolla about 7 mm long; ligule about 2 mm wide; teeth unequal, 0.2 to 0.6 mm long; corolla-tube 1.5 to 2 mm long, abruptly swollen at summit, pubescent with very short (up to 0.13 mm long) acicular hairs; anther-tube about  $3.3 \times 1$  mm dis.; filaments extend beyond appendages 0.4 mm; appendages 0.5 mm long, oblong, obtuse, united; style-branches 0.8 mm long, 0.08 mm wide, attenuate at tip, yellow; achenes dark purplish brown, 2 to 2.25 mm long, 0.4 to 0.5



mm wide, very slightly attenuate to summit, 0.35 mm wide below pappus-disk, gradually and strongly attenuate downward, base 0.2 to 0.25 mm wide, hollow, thinly white-calloused, subterete to subcompressed, obscurely 5-angled, obscurely 10- to 13-ribbed, ribs unequal, mature achenes divided by very narrow longitudinal grooves into 5 main costæ, each costa containing 2 or 3 often unequal ribs, very finely spiculate near summit; pappus yellow, 3 to 4 mm long, 1-seriate, bristles fine, soft, barbellulate, united at base, persistent. Flowering June; ligule, anthers, and style yellow. (*Crepis scaposa* Chang, in *Sinensia* 3(8):201, fig. 1, 1933; *Hieracium runcinatifolium* Chang, in *Bull. Fan Mem. Inst. Biol.* 6:69, 1935.)

Known only from the type locality.

CHINA: southeastern Szechwan, Chi-kiang Hsien, roadside, 900 to 1200 m alt., *Fang 1280* (Nanking type, B cotype).

#### RELATIONSHIP

Although unique in its almost truncate achenes, yet this species shows more affinity with *Youngia* than with *Crepis* or any other genus. There are never more than five achenes in a head and the mature achenes are slightly compressed and angular, resembling in this respect the inner achenes of most species of *Youngia*. The lyrate leaves with broad rounded terminal segments resemble the more common type of leaf in *Y. japonica*, and the indumentum of the leaves is exactly that of *japonica* and *paleacea*. The involucre and floral characters are like those of other species of *Youngia*.

### SECTION 4. CREPIDOPSIS

#### 8. *Youngia tenuifolia* (Willd.) comb. nov. (Figs. 9–12)

Perennial, glabrous, except caudex and involucre, 10 to 70 cm high; caudex woody, simple, and 3 to 8 mm wide at crown, or 2- to 4-divided and up to 4 cm wide, main divisions subdivided, prolonged into a strong taproot 3 to 10 mm wide, crown covered with brown bases of old leaves, usually with brown or tawny wool between the leaf-bases; caudical leaves up to 30 cm long, 5 to 8 cm wide, pinnately parted into lanceolate, linear, or filiform, acute or acuminate segments, lateral segments  $\pm$  salient, simple or incompletely bipinnate with 1 to 3 segments mostly on lower margin, gradually reduced into the strong subterete petiole with broad thickened indurate base; cauline leaves similar or sessile, linear or filiform, uppermost bractlike; stems one, several, or many, erect, terete, striate, branched from below or about the middle, branches strict or divaricate; peduncles slender, often with 1 or 2 bracts or abortive heads, not or little thickened near head; heads  $\pm$  nodding in fruit; involucre cylindric, becoming partly reflexed in fruiting heads, pubescent or glabrous; outer involucre bracts 5 to 8, unequal, variable in length in different forms, ranging from less than  $\frac{1}{4}$  up to  $\frac{1}{2}$  as long as inner bracts, ovate or lanceolate, acute, crested with a small dorsal claw or wing near tip, usually  $\pm$  reflexed in anthesis; inner involucre bracts 8 to 12, lanceolate, acute or obtuse, scarious-margined, becoming carinately spongy-thickened dorsally, crested with a salient claw or wing near tip, ventrally

glabrous or obscurely pubescent near tip; receptacle areolate, fimbriæ low, glabrous; corolla 10 to 20 mm long; ligule 2 to 3.25 mm wide, yellow; corolla-tube 2.5 to 4 mm long,  $\pm$  pubescent with short broad-based conical hairs; anther-tube 3 to 6 mm long; filaments long or short; appendages oblong, obtuse, obliquely acute or notched, united; style-branches yellow or brown *in sic.*; achenes black or brown, 3.5 to 7.5 mm long, unequally ribbed; pappus white or yellowish white, 4 to 7 mm long, 1- to 2-seriate, barbellulate, persistent. Flowering June to September; flowers pale or bright yellow, anthers  $\pm$  green *in sic.*, style yellow or brown *in sic.*

Middle and southern Siberia from Kamchatka and Amur Provinces south to Manchuria, west to Semipalatinsk (and Ural Mountains?); Outer Mongolia, Sin-kiang, and Turkestan; Himalaya Mountains, in western Tibet, upper Punjab, and Kashmir; Assam in Khasia(?); open rocky and gravelly places on river banks, plains, steppes, mountain slopes and meadows, in cleared forests, in rock crevices on cliffs and high mountains, from 2000 (or less) to 4545 m alt.

Polymorphism in this widely distributed species has long been recognized. Enough is known about its chromosomes to indicate that many forms are polyploids which probably originated through hybridization between two diploid, 10-chromosome forms. The chromosome numbers which have been found in plants grown from seed collected in the wild are 15, 20, and 24. It seems, however, that the type specimen (Herb. Willd. 14762-2 was accepted as the type rather than 14762-1 because it has partly mature achenes) probably had 10 chromosomes. This inference is drawn from the small size of its stomata on cauline leaves and its regular, small pollen grains, both of which closely resemble those of *Crepis multicaulis*, a 10-chromosome species. The type "locality" is Siberia, and specimens closely resembling the type have been collected in the Baikal region. Another apparently 10-chromosome form is known from the Altai region. As a basis for comparison at least, both of these putative diploid forms will be recognized as subspecies.

All of the 15-chromosome plants thus far found have been grown from seed collected in Mongolia. But that similar forms occur in Siberia is indicated by the irregular, larger pollen and larger stomata of certain herbarium specimens. Emasculation of very young florets on 15-chromosome plants has shown that they are capable of producing viable seed without fertilization. Accordingly they may be considered as at least partial apomicts. But they may also be capable of limited sexual reproduction, and the 24-chromosome plants, also from Mongolia, may have arisen in this way. These apomictic forms are extremely variable and it is probable that numerous distinct, local races exist in Siberia, Mongolia, and the region to the southeast which may be recognized eventually as subspecies. Too little is known as yet about their distribution to warrant such a treatment and, with one exception, those which are represented by available herbarium specimens will be listed below as numbered forms. The exceptional form just mentioned is very distinct from all the others, and a sufficient number of collections have been made to show that it is distributed over a considerable area in central Outer Mongolia. Accordingly this form is recognized as the third subspecies.

The fourth subspecies includes a series of "tetraploid" forms ( $2n = 20$ ) which occur in the Himalaya region, the mountains of Turkestan, and the Altai Mountains. These also are characterized by several distinctive morphological features.

## SUBSPECIES

## KEY TO THE SUBSPECIES OF YOUNGIA TENUIFOLIA

- Involucre 8 to 10.5 mm high; florets 10.5 to 14.5 mm long; anther-tube 3.5 to 4.8 mm long; style-branches 1.2 to 2.2 mm long; mature achenes black.
- Stems few, 1 to 5 mm thick at base; branches paniculate, strict; achenes, at least the outer, definitely compressed dorsoventrally.
- Lobes of leaves mostly broadly linear, lanceolate, or elliptic; inflorescence cymose-paniculate; involucre bracts rather densely tomentose with long, crisp hairs, the innermost bracts with relatively narrow scarious margins; achenes with a short beak... *a. typica*
- Lobes of leaves narrowly linear or filiform; inflorescence racemose- to cymose-paniculate; involucre bracts sparsely tomentose with short hairs, the innermost with scarious margins broader than the green central portion; achenes attenuate at the apex, but not beaked..... *b. altaica*
- Stems numerous, 0.5 to 1.3 mm thick at base; branches dichotomous, divaricate; achenes only slightly or not compressed dorsoventrally. *c. tenuicaulis*
- Involucre 10 to 12 mm high; florets 12 to 19 mm long; anther-tube 5 to 5.5 mm long; style-branches 2.5 to 3 mm long; achenes brown or rarely black..... *d. diversifolia*

**8a. *Youngia tenuifolia typica* nom. nov.**—Plant 15 to 55 cm high; stem 3 to 5 mm wide at base, remotely paniculately branched from near base, lower branches elongate, aggregate inflorescence corymbiform; cauline leaf segments 1 to 5 mm wide; peduncles 4 to 20 mm long; heads 9- to 15-flowered; involucre 8 to 10.5 mm long, about 3 mm wide at middle in anthesis, pubescent with pale yellowish eglandulose many-celled pili-form trichomes; outer involucre bracts 5, unequal, longest  $\frac{1}{3}$  to  $\frac{1}{2}$  as long as inner bracts, lanceolate, mediodorsally nerved or narrowly carinate and like inner bracts crested with a small wing or claw near tip; inner bracts 7 to 8, obtuse; corolla 11 to 20 mm long; ligule about 2 mm wide; teeth 0.5 to 0.75 mm long, conspicuously gland-crested, not hooded; corolla-tube 3.25 mm long; anther-tube 3.5 to 5  $\times$  1.25 mm dis.; filaments long, extending beyond appendages 1.25 to 1.5 mm; appendages about 1 mm long, oblong, obliquely acute, united; style-branches 1.2 to 2.2 mm long, 0.1 mm wide, attenuate at tip; achenes black, 4.5 to 6.5 mm long, 0.7 mm wide, dorsoventrally subcompressed, strongly attenuate into a short coarse yellowish beak, abruptly expanded at summit into the broad, nearly flat pappus-disk, gradually attenuate to the constricted yellow-calloused base, 10- to 12-ribbed, ribs unequal, 3 to 5 stronger, rounded, spiculate toward summit; pappus dull white or pale cream, 4 to 6 mm long, 2-seriate, setæ nearly equal, rather fine, soft. (*Crepis tenuifolia* Willd., Sp. Pl. 3:1606, 1804; *Crepis baicalensis* Ledeb., in Mem. Acad. Petersb. 5:559, 1812; *Lagoseris tenuifolia* Reichb., Ic. Crit. 1: t. X, f. 19, 20, 1823; *Barkhausia tenuifolia* DC., Prod. 7:155, 1838; *Berinia tenuifolia* Sch. Bip., in Pollichia, 22-24:316, 1866; *Crepis graminifolia* Ledeb., ex Reichb. et Spr. fide DC.—Cf. other syn. not verified by the present

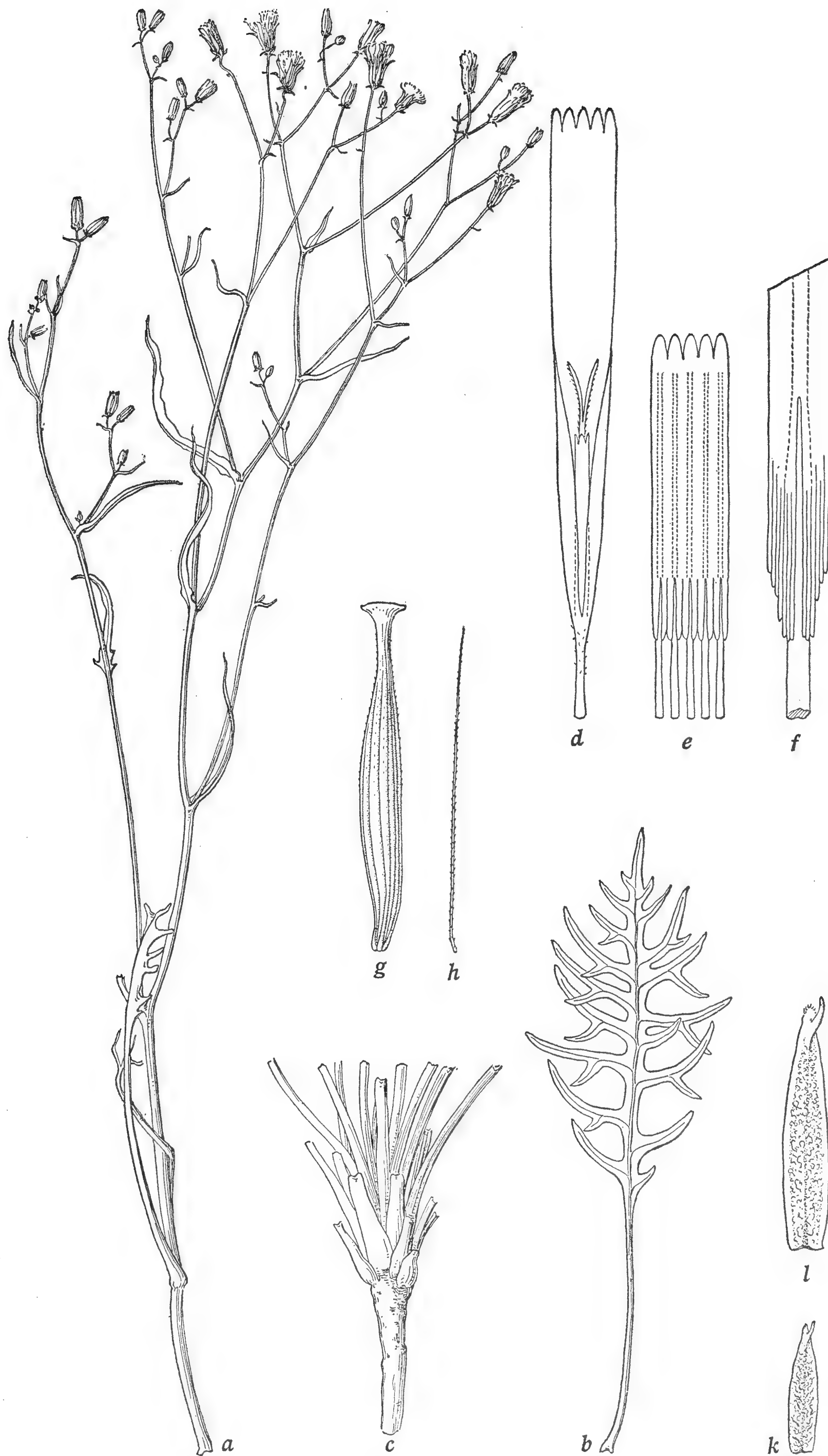


FIG. 9—*Youngia tenuifolia typica*, from type (Herb. Willd. 14762-2): *a*, stem and inflorescence,  $\times \frac{1}{2}$ ; *b*, caudical leaf,  $\times \frac{1}{2}$ ; *c*, caudex,  $\times \frac{1}{2}$ ; *d*, floret lacking ovary,  $\times 4$ ; *e*, anther-tube,  $\times 8$ ; *f*, detail of appendages,  $\times 32$ ; *g*, *h*, achene and a pappus-bristle,  $\times 8$ ; *k*, *l*, outer and inner involucre bracts,  $\times 4$ .



authors in Ledeb., Fl. Ross. 2:837, and in Herder, in Bull. Soc. Nat. Moscow 43:197.) (Fig. 9.)

This subspecies, though very variable in habit, is characterized by the shortly beaked achenes. The pollen is 3-pored, regular, and approximately the same size as that of *Crepis multicaulis*, a diploid 10-chromosome species, and the stomata on a cauline leaf are similarly comparable in size. No cultures, however, have been grown and the chromosome number is not known.

Southern Siberia from Irkutsk to Nertchinsk Provinces, south to northern Manchuria and Mongolia.

SIBERIA: without definite locality, in Herb. Willd. 14762-2 (B), *type*; Transbaicalia, Nertchinsk, *Sensinoff and Turczaninoff* (NY); Irkutsk Province, Nizni County, near Oka River, *Krystofovich* in 1910 (UC); Trans-Baikal region, Barguzinsk highway, St. Tataurivo, *Poplavska, Poplavski, and Ditmer* 2430 (Lenin); Irkutsk government, Balachansk district, Podubalsk, *Maldsev* 474 (Lenin). MANCHURIA: Khingan (Hingan) Mountains, valley of Tarim River, *Ivashkevich* 384 (Lenin); north slope, Melekei, Khingan Mountains, *Potanin and Soldatov* in 1899 (Lenin); western Hingan Mountains near Dzhalatun, *Litvinov* 2519 (Lenin). MONGOLIA: Mashcha River valley, *Klementz* in 1897 (Lenin).

8b. ***Youngia tenuifolia altaica*** subsp. nov.—Folii segmentes lineares; inflorescentia racemosa; capitula erecta; squamæ involucri minute tomentulosæ vel glabratae; interiores cum margine scariosa parte viride interiore latiore; corollæ flosculorum exteriorum 10.5–11.5 mm longæ; antheræ 4–4.2 mm longæ; rami stigmati 1.5–1.8 mm longi; achænia nigra, apice attenuata, erostrata, 4–5 mm longa.

Plant 26 to 36 cm high; stem 1 to 3 mm wide at base; remotely paniculately branched from middle or near base, lower branches elongate, upper more numerous and much shorter, aggregate inflorescence racemiform to corymbiform; cauline leaf segments filiform or linear and then up to 3 mm wide; peduncles 2 to 15 mm long; heads 9- to 10-flowered; involucre 8 to 9.5, 10.5 mm long, about 2.5 mm wide at middle in anthesis, pubescent with short pale waxy eglandulose several- or many-celled piliform trichomes; outer involucre bracts 5, nearly equal, 1 to 2 mm long, lanceolate, acute, mediodorsally nerved and like inner bracts crested with a narrow curved claw near tip; inner bracts 6 to 8, acute; corolla 11 to 11.5 mm long; ligule about 2 mm wide; teeth 0.3 to 0.75 mm long, conspicuously gland-crested, hooded; corolla-tube about 3.5 mm long; anther-tube 3.5 to 4.2  $\times$  1 mm dis.; filaments short, extending beyond appendages 0.4 mm; appendages 0.6 to 0.7 mm long, oblong, obtuse, united; style-branches 1.5 to 1.8 mm long, 0.15 mm wide, attenuate at tip, yellow; achenes black, 4 to 5 mm long, 0.6 to 0.9 mm wide, fusiform, dorso-ventrally subcompressed or angular, strongly attenuate to the narrow (0.3 to 0.4 mm wide) neck, with conical pale summit, constricted at the pale-calloused hollow base, 10- to 12-ribbed, ribs unequal, 4 to 5 stronger, rounded, spiculate; pappus white, 4 to 5 mm long, 2-seriate, setæ nearly equal, rather fine, soft. (Fig. 10.)

Southwestern Altai Mountain region.

SIBERIA: Semipalatinsk, Lake Zaissan Nor, ex Herb. Petrop. (NY, *type*; K, cotype); Kurchumsk, Kamenogorsk, between Marasinsk and the

Kurchum River, *Goncharova and Borisova 1175* (Lenin); Zaisank district, northern slopes of Tarbagatai, *Rieznichenko 141* (Lenin); Altai Mountains, *Politow* (UWG, NY, US 597710).

Distinguished from the preceding by the more glabrate involucre, the broad scarious margins of the inner bracts, and the shorter, unbeaked

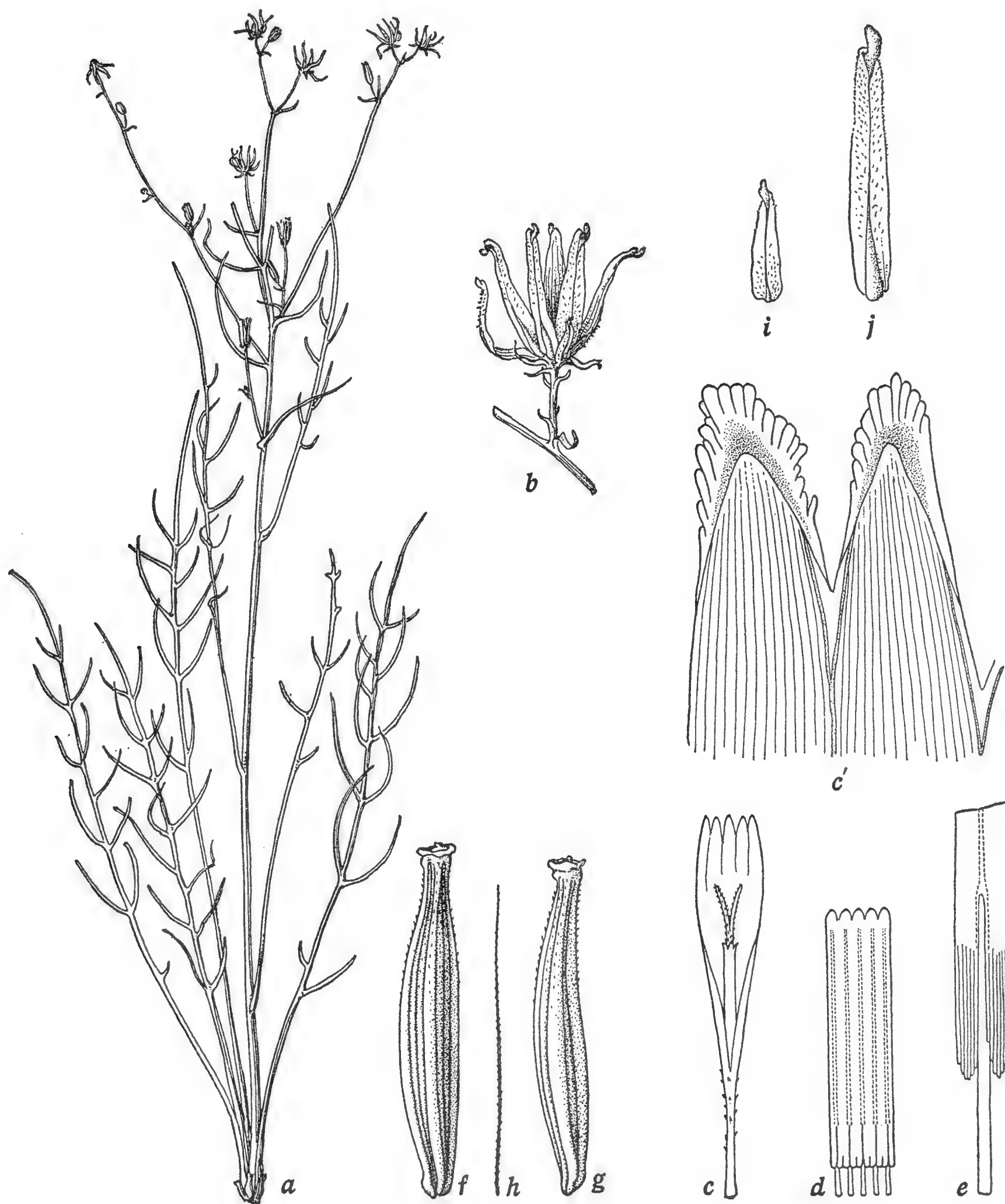


FIG. 10—*Youngia tenuifolia altaica*, from type and cotype (NY, K): *a*, plant,  $\times \frac{1}{2}$ ; *b*, old head,  $\times 2$ ; *c*, floret lacking ovary,  $\times 4$ ; *c'*, detail of ligule-teeth,  $\times 50$ ; *d*, anther-tube,  $\times 8$ ; *e*, detail of appendages,  $\times 32$ ; *f*, *g*, *h*, two achenes and a pappus-bristle,  $\times 8$ ; *i*, *j*, outer and inner involucral bracts,  $\times 4$ .

achenes. The known range of this subspecies is relatively restricted, as all of the specimens cited are from the mountains about Lake Zaissan Nor, in Semipalatinsk Province, southern Siberia, but it may extend eastward through the relatively little-explored mountains of the northern

part of Chinese Turkestan, and in this area approach more nearly the range of subspecies *typica* than is apparent from present collections. Like *typica*, this subspecies appears to be a diploid with the chromosome number  $n=5$ , but it has not been seen in living condition.

8c. ***Youngia tenuifolia tenuicaulis*** subsp. nov.—Planta suffruticulosa; caules plures, tenues, rigidi, ramosissimi; rami dichotomi; pedunculæ 0.3–4.3 mm longæ, tenuissimæ; involucrium 7–10 mm longum; squamæ glabræ vel minute tomentulosæ; achænia nigra, fusiformia, erostrata, 3.5–4 mm longa.

Plant 10 to 15, 20 cm high, suffruticulose; caudical leaves small, narrow, acutely dentate or pinnately parted into linear acute or acuminate segments; stems many, slender, rigid, from near base dichotomously many-branched forming a dense globose obconical mass crowned with many flower-heads; peduncles 0.3 to 4.3 cm long, very slender, rigid, usually 1-bracteate; heads about 10-flowered; involucre 7 to 10 mm long, about 3 mm wide at middle in anthesis, glabrous or slightly pubescent; outer involucre bracts 5 or 6, unequal, longest  $\frac{1}{4}$  as long as inner bracts, like inner bracts mediodorsally nerved and crested with a short narrow curved claw near tip; inner bracts 8, obtuse; corolla 10.5 to 13.5 mm long; ligule 2 to 3 mm wide; teeth 0.3 to 0.8 mm long, conspicuously gland-crested, not or slightly hooded; corolla-tube 2.5 mm long, sparsely pubescent; anther-tube  $3.25$  to  $5.2 \times 1.25$  mm dis.; filaments long, extending beyond appendages 1 mm; appendages 0.75 to 1.2 mm long, oblong, obliquely acute or unequally notched at tip; style-branches 1.25 to 2.25 mm long, 0.15 mm wide, obtuse at tip, yellow; achenes black or blackish, 3.5 to 4 mm long, 0.75 mm wide, fusiform, nearly equally attenuate to both ends, with a short neck at summit 0.4 mm wide, pappus-disk slightly expanded, constricted at the yellow-calloused oblique hollow base, 10-ribbed, ribs unequal, 4 to 5 stronger, rounded, spiculate; pappus white or dusky white, 4 to 5 mm long, 1-seriate, fine, soft. (Pl. 1; fig. 11.)

No cultures have been grown of this subspecies, but it is presumably a polyploid apomict. The pollen is irregular in size and both 3-pored and 4-pored grains occur. But it is very distinct from all other forms of the species in its low stature, small leaves, many stems, and diffuse habit. And sufficient collections have been seen to indicate a fairly wide distribution.

Central and western Outer Mongolia and western Dzungaria, mountain slopes and cliffs, in rock crevices, among stones, and in sandy places.

OUTER MONGOLIA: south central part, Artsa Bogdo Mountains, foothills, steep slopes, 36.8 km east of camp 16 in Andrews' Third Asiatic Expedition, *Chaney* 352 (UC 295342), *type*; central part, Ologai River, rocks, *Gorbunov* 1354 (Mosc); northern part, Lake Kosogol region, near Hathyl, southern stony mountain slope, *Dadochkin* 1358 (Mosc); western part, Chan gai (Khan gai) Mountains, Sharagalsa River valley, steppe, sandy and rocky places, *Pavlov* 1496 (Mosc); *ibid.*, Chan gai Mountains, Halzinchinbulyk River, near Zany-gechen, stony slope, *Pavlov* 1356 (Mosc); *ibid.*, Chan gai Mountains, Shara-usu River, cliffs, *Pavlov* 1357 (Mosc); *ibid.*, near Choiren, rocks, *Kondratiev* 1355 (Mosc); *ibid.*(?), Altai Mountains, *Littledale* in 1897 (K). CHINESE TURKESTAN:





*Youngia tenuifolia tenuicaulis*, type (UC)





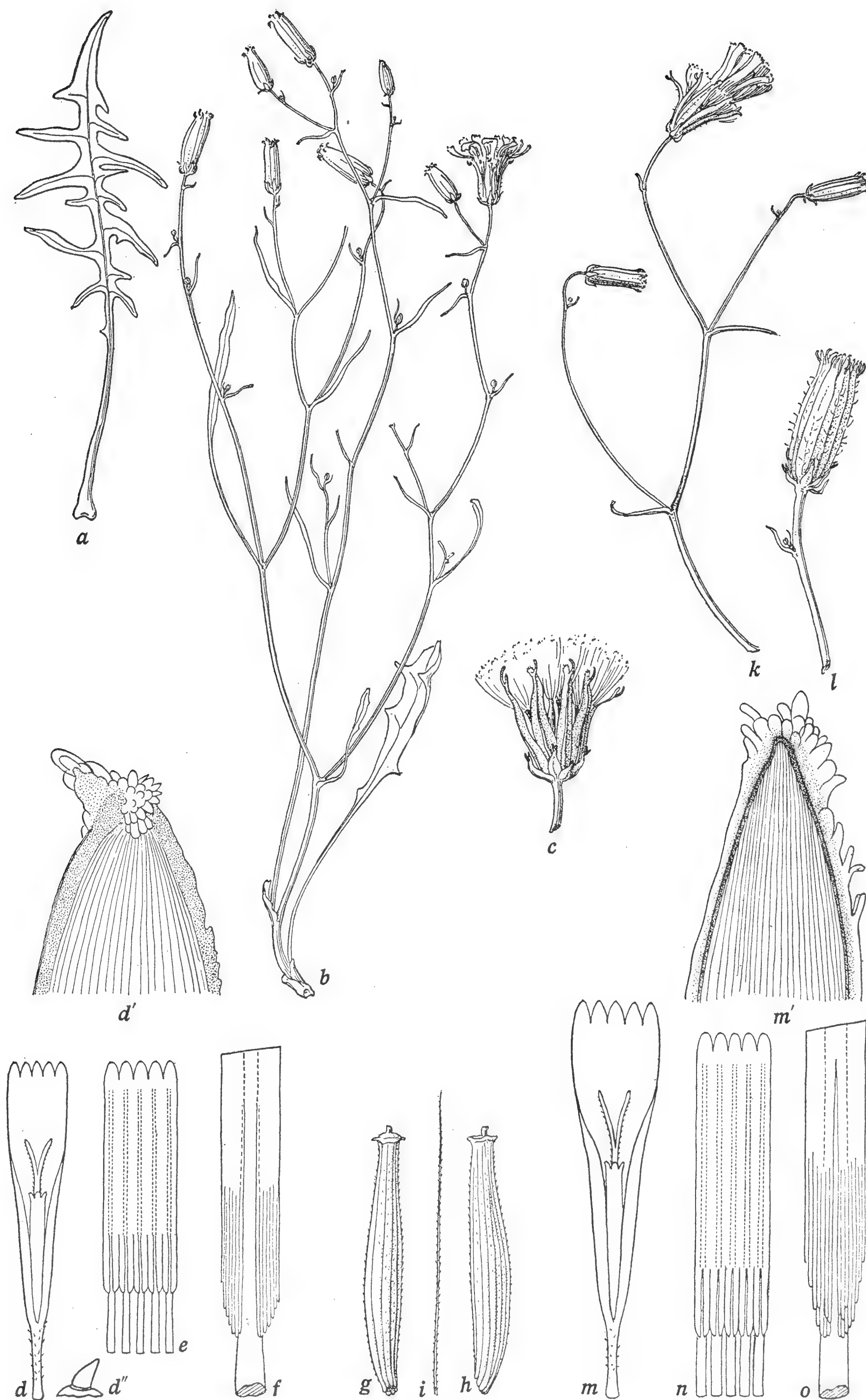


FIG. 11—*Youngia tenuifolia tenuicaulis*, *a*, *c*–*i*, from type (UC 295342); *b*, from Kondratiev 1355 (Mosc); *k*–*o*, from Pavlov 1356 (Mosc): *a*, typical rosette leaf,  $\times 2$ ; *b*, young leaf, stem, and branches with heads,  $\times 2$ ; *c*, mature head,  $\times 2$ ; *d*, floret lacking ovary,  $\times 4$ ; *d'*, detail of ligule-tooth,  $\times 50$ ; *d''*, detail of trichome from corolla-tube,  $\times 50$ ; *e*, anther-tube,  $\times 8$ ; *f*, detail of appendages,  $\times 32$ ; *g*, *h*, achenes,  $\times 8$ ; *i*, pappus-bristle,  $\times 8$ ; *k*, part of branch with 3 heads,  $\times 2$ ; *l*, head,  $\times 2$ ; *m*, floret lacking ovary,  $\times 4$ ; *m'*, detail of ligule-tooth,  $\times 50$ ; *n*, anther-tube,  $\times 8$ ; *o*, detail of appendages,  $\times 32$ .

Tarbagatai, Liazug Basin, source of the Liazug River, *Roshevitz 1036* (UC).

8d. *Youngia tenuifolia diversifolia* (Ledeb.) comb. nov.—Plant 13 to 40 cm high; leaves extremely variable, sometimes short, narrow, with few or many filiform linear or narrowly lanceolate segments, sometimes much longer, with linear segments up to 5 mm wide; stems 1 to 3 or more, 1 to 4 mm wide at base, remotely paniculately branched from middle or near base, aggregate inflorescence corymbiform; peduncles 0.7 to 2.7 cm long; heads 10- to 16-flowered; involucre 10 to 12 mm long, 3 to 4 mm wide at middle in anthesis, pubescent with pale waxy many-celled piliform trichomes; outer involucral bracts 5 to 7, unequal,  $\frac{1}{4}$  to  $\frac{1}{3}$  as long as inner bracts, like inner bracts mediodorsally nerved and crested with a narrow grayish-black curved claw near tip; inner bracts 7 to 8, obtuse; corolla 12 to 20 mm long; ligule 2.5 to 3.25 mm wide; teeth 1 to 1.5 mm long, conspicuously gland-crested; corolla-tube about 4 mm long, densely pubescent with coarse broad-based conical hairs; anther-tube 5 to 6  $\times$  1.5 mm dis.; filaments long, extending beyond appendages 1.25 mm; appendages 1.25 mm long, oblong, obliquely acute, united; style-branches up to 2.5 to 3 mm long, 0.15 mm wide, attenuate at tip; achenes brown (except in one specimen noted below), 5.75 to 7.5 mm long, 0.75 to 1 mm wide, fusiform, gradually strongly attenuate to the 0.25 to 0.4 mm wide neck, summit very slightly expanded, pappus-disk relatively narrow, constricted at the pale-calloused hollow base, 10- to 12-ribbed, ribs unequal, 5 stronger, rounded, strongly spiculate; pappus white, 6 to 7 mm long, 1-seriate, rather fine, soft. Flowers bright yellow, anthers green, style brown *in sic.* (*Prenanthes diversifolia* Ledeb., ex Spreng., Syst. Veg. 3:657, 1826; *Youngia diversifolia* Ledeb., Fl. Ros. 2:837, 1844–1846, excl. syn.) (Fig. 12, k–q.)

From the Altai Mountains, through the mountains of Turkestan and western Tibet to the Himalayan mountain region.

SIBERIA: Altai, Oirotsk, autonomous region Khrebet, Sailiugem Mountains, Bugusun Pass, *Shishkin and Chilikina* in 1931 (Lenin). RUSSIAN TURKESTAN: Semirich (Semirychensk), Leisinsk district, *Lipshitz* in 1928 (Lenin); Talask Alatau, Tenisman gorge, *Iljin 355* (Lenin). WESTERN TIBET: without definite locality, 3636 to 4545 m alt., *Falconer 4188* (K). INDIA: Kashmir Province, Ashkoley (Askole), 3333 m alt., *Clarke 30322* (K); Karakorum (Mountains), 3636 m alt., *Clarke 30143* (K); Ladak, Khalotse Yuru, *Stewart* in 1911–1912 (UC); Sonamarg, rock crevices, 2727 m alt., *Stewart 12386a, b, c* (UC); Kashmir, *Jacquemont 995* (K, P); Punjab, Kulu-Lahaul, *Drummond 22801* (K, UC); *ibid.*, Lahaul, between Fugiling and Gondla, about 3030 m alt., *Drummond 22799* (K, UC); *ibid.*, Kyelang, *Drummond 25569* (K); western Nepal, near Kaiva, 3030 to 3333 m alt., *Duthie 5726 part* (K); Kumaun, Kali Valley, Nepal side, near Kaiva, 3030 to 3333 m alt., *Duthie 5726 part* (Calcutta), form with black achenes; (?) Assam Province, Khasia, 1500 to 1800 m alt., *Hooker and Thompson*, as *Prenanthes alata* (NY).

The excellent habit drawing of Ledebour's *Prenanthes diversifolia* (Ic. Pl. Flor. Ross. 2: t. 152, 1830) is unquestionably of this large-headed subspecies. It is nearly matched by the specimen of Lipshitz from Semirychensk cited above, and, if drawn life size, as was most probably the

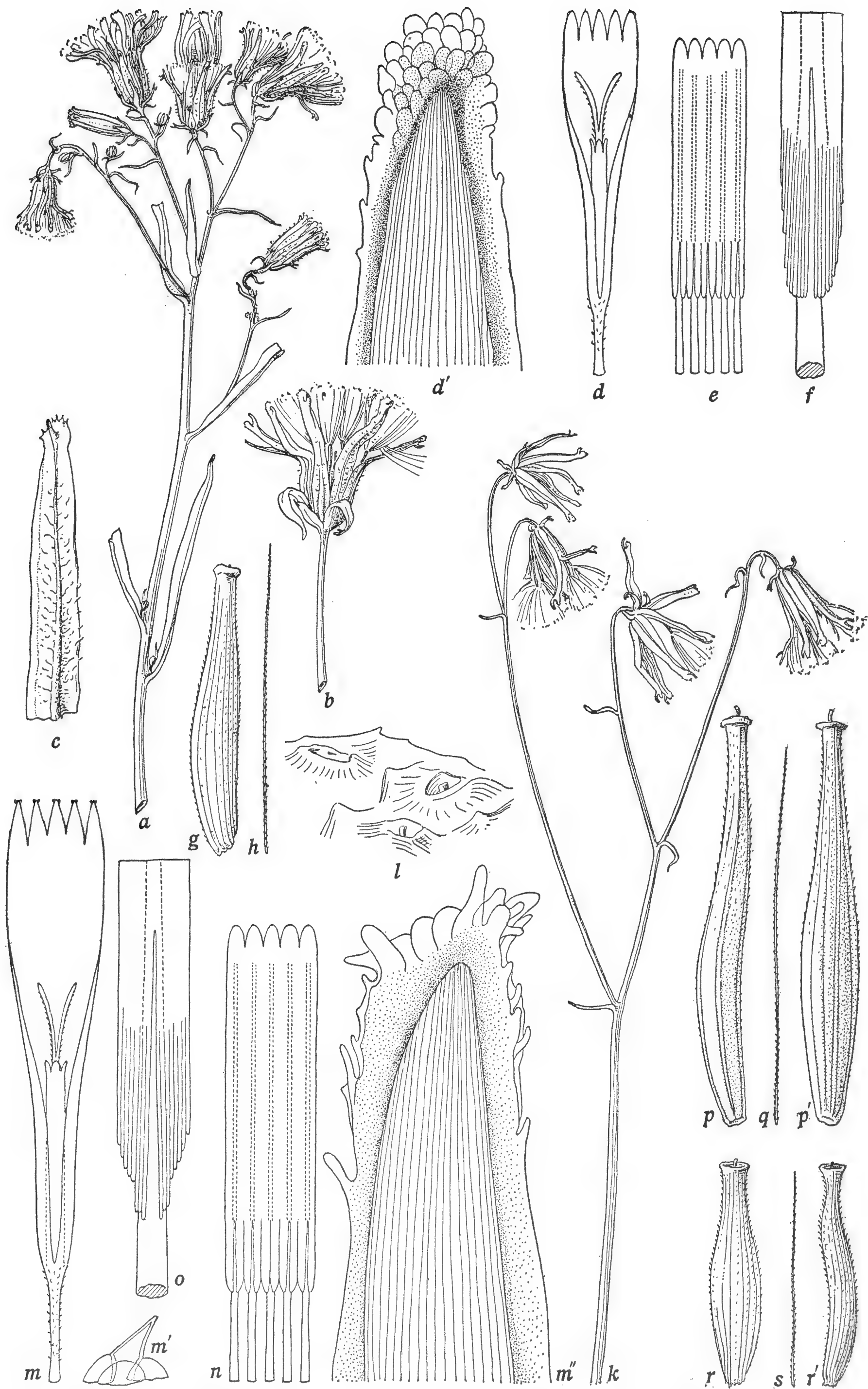


FIG. 12—*Youngia tenuifolia*, a-h, apomictic triploid(?), Pavlov 1359 (Mosc); k-q, *diversifolia*, from Stewart 12386b (UC 476317), type; r, s, *altaica* race 5, Karo 262A (UWG): a, branch,  $\times 1$ ; b, head,  $\times 2$ ; c, inner involucral bract, outer face,  $\times 4$ ; d, floret lacking ovary,  $\times 4$ ; d', detail of ligule-tooth,  $\times 50$ ; e, anther-tube,  $\times 8$ ; f, detail of appendages,  $\times 32$ ; g, h, achene and a pappus-bristle,  $\times 8$ ; k, branchlet with mature heads,  $\times 1$ ; l, detail of receptacle,  $\times 25$ ; m, floret lacking ovary,  $\times 4$ ; m', detail of hair from corolla-tube,  $\times 50$ ; m'', detail of ligule-tooth,  $\times 50$ ; n, anther-tube,  $\times 8$ ; o, detail of appendages,  $\times 32$ ; p-s, achenes and pappus-bristles,  $\times 8$ .



case, although no scale was given, agrees in the length of its involucre and florets with the specimens cited above. Furthermore, the locality given with the original description, "Imaus," must have referred either to the mountains of Turkestan or to the Himalaya, all within the range of this subspecies.

It should be noted that an authentic specimen of Ledebour in the Leningrad Herbarium, which was originally labeled *Crepis baicalensis* and was later annotated as *Prenanthes diversifolia*, was collected near Lake Baikal and has been identified as *Youngia tenuifolia typica*. But there is another specimen in the same herbarium (ex Herb. Ledebour) which was labeled *Prenanthes diversifolia* in Ledebour's script. The locality mentioned on the label is unknown to the present writers, but this specimen might well be the type from which the illustration in *Icones Plantarum Floram Rossicam* was made. Furthermore, the pollen on this plant consists partly of 4-pored grains. Thus, although Ledebour applied the name *P. diversifolia* to more than one of the subspecies recognized here, yet there exists an authentic specimen which agrees with the first published description and illustration of *P. diversifolia* and which may be accepted as the type of this subspecies.

As noted above, the chromosome number of this subspecies has been found to be  $2n=20$ , and the pollen contains a majority of 4-pored grains, a characteristic common in tetraploids of *Crepis* and related genera. The stomata, moreover, are considerably larger than those of the other subspecies (length of guard-cells 32 to 37  $\mu$ ). The great majority of the specimens cited agree with the collections of Stewart from Kashmir, of which the chromosome number is known, in their pollen and stomatal characteristics, and hence may be assumed to possess also 20 somatic chromosomes. At least one specimen, however, that of Shishkin and Chilikina from the Altai, has the stomata and pollen of a triploid ( $2n=15$ ), although agreeing morphologically with subspecies *diversifolia*.

#### APOMICTIC POLYPLOID FORMS

In addition to the subspecies listed above, there are apparently many races of *Y. tenuifolia*, most of which are intermediate between or in one way or another combine the characteristics of two subspecies. The somatic chromosome number of one of these races has been found to be 15, an "unbalanced" number which could be maintained only by partial or complete apomixis, and preliminary studies (unpublished) of embryo-sac development indicate that this race is actually apomictic. Since most of the other races of this type agree with it in possessing very irregular pollen, including 3-pored and 4-pored grains in about equal quantities, the probability is that they are also apomictic triploids. Although the relatively small number of specimens seen does not permit a detailed discussion of these races, the following may be given as typical examples:

Subsp. *typica*, RACE 1. Indistinguishable from the diploid form, except in its robust, rigid, more densely caespitose stems and narrow (1 to 2 mm wide) leaf-segments. MONGOLIA: Chinchilta, near Ulan-Bator-Hota (Urga), *Ikonnikov-Galitzky* 288 (UC 475115, Lenin).

RACE 2. Distinguishable from the diploid form only by the short caudical leaves (10 to 11 cm long, including petiole), which are only about  $\frac{1}{3}$  as long as the rigid and relatively little-branched stems. NORTHERN MONGOLIA and KHANHAI: Khalzan-hei-bulyk spring, *Ikonnikov-Galitzky* 595 (Lenin).

RACE 3. A large, robust plant with broadly lanceolate leaf-segments. Habit, inflorescence, and achenes of *typica*, but involucre bracts glabrate as in *altaica*, and the innermost with broad scarious margins, though these are narrower than in *altaica*. SIBERIA: Irkutsk government, Tunkinsk district, Saisank Mountains, *Komarov* in 1902 (Lenin).

RACE 4. Caudical leaves short, 5 to 12 cm long; habit of flowering stem suggestive of *diversifolia*. Involucres densely tomentose, 9 to 10 mm long, and hence between *typica* and *diversifolia*; corollas 11 to 12 mm; anther-tube 4.5 mm; style-branches 1.5 to 2.1 mm; achenes as in *typica*. The chromosome number of this race has been counted,  $2n = 15$ . MONGOLIA: east of Karakorum,  $47^{\circ}\text{N.}$ ,  $104^{\circ}$  to  $105^{\circ}\text{E.}$ , *N. Krasheninnikov* in 1925 (UC 544644), ex hort. genet. Calif. no. 1826; *ibid.*, *Krasheninnikov and Zamatkinov* 518 (Lenin); Lake Kossogol, *Peretomin* in 1901 (Lenin).

Subsp. *altaica*, RACE 5. Leaves with lanceolate lobes, 2 to 3 mm broad, resembling those of *typica*; breadth of blade about 8 cm; involucres as in *altaica*; achenes 3.5 to 4 mm long, with a very short beak, 0.3 to 0.5 mm long, and hence intermediate between *typica* and *altaica*. EASTERN SIBERIA: along the Nertsha River, Nertshinsk, *Karo* 262A (K, B, P, UWG). (Fig. 12, r, s.)

RACE 6. Similar to race 5, but dwarf; plant 10 to 13 cm high; leaf-lobes linear, 0.5 to 1 mm broad; involucres typical of *altaica*, except for the narrower scarious margins of the innermost bracts; achenes 4 to 4.5 mm long, as in race 5, intermediate between *altaica* and *typica*. MONGOLIA: Kentei Mountains, at source of Kerulen and Onon Rivers, *Ikonnikov-Galitzky* 1599 (Lenin). ALTAI REGION: "in rupestribus apricis frequens (L. M. B.)," ex Herb. Meyer no. 1353, as *Crepis pulcherrima* var. *altaica* (Lenin).

RACE 7. Stems caespitose as in *tenuicaulis*, but their thickness and the character of the caudical leaves and of the involucres typical of *altaica*. Achenes 3.5 to 4 mm long, with a definite beak about 0.8 mm long, approaching that of *typica*. MONGOLIA: valley of Halzan River at source of Tola River, Kentei Mountains, *Ikonnikov-Galitzky* 3457 (UC).

RACE 8. Leaves as in *altaica*, but inflorescence cymose as in *diversifolia*. Involucres 10 to 11 mm high, intermediate between *altaica* and *diversifolia*; pubescence of bracts as in *altaica*, but scarious margins of innermost bracts narrow as in *diversifolia*. Corollas 12 to 14.5 mm long; anther-tube 4.5 mm; style-branches 2.2 mm; these measurements all intermediate between *altaica* and *diversifolia*. Achenes black, shaped as in *altaica*, but larger, 6 to 6.5 mm long. SOUTHERN SIBERIA: Altai: Oirotsk, Khrebet, Sailiugem Mountains, *Shishkin and Chilikina* in 1931 (Lenin); Semirychensk region, Dzhungarak Alatau, near Konuroba River, *Sapozhnikov and Tripolitov* in 1915 (Lenin).

RACE 9. Leaf-lobes very long, 2.5 to 4 cm long, linear. Stems more robust than in *altaica* but inflorescence similar. Involucres 9 to 10 mm,

somewhat more tomentose than in *altaica*; scarious margins of innermost bracts intermediate. Achenes 6 mm long, shaped as in *altaica* but deep brown in color. The evidence from pollen-grains and stomata indicates that this is a tetraploid. SIBERIA: Semipalatinsk district, Semeitau Mountains, *Zaprjagaev* 1804 (Lenin).

Subsp. *tenuicaulis*, RACE 10. Habit, stems, and leaves typical of *tenuicaulis* but involucre 9 to 10.5 mm high; corollas 13.5 mm long; anther-tube 5 mm long; style-branches 2.2 mm long. Achenes as in *tenuicaulis*. RUSSIAN TURKESTAN: Semiriche (Semirychensk) region, southern foothills of the Kungeitau Mountains, *Sapozhnikov and Tripolotov* in 1915 (Lenin).

RACE 11. Stems tall and flexuose, 30 cm high; branches of inflorescence elongate, 4 to 15 cm long, but dichotomous as in *tenuicaulis*. Involucre as in *tenuicaulis* but 9 to 10 mm high. Florets 13 mm long; anther-tube 4.5 mm long; style-branches 2.1 mm long. Achenes shaped as in *tenuicaulis* but reddish brown when immature. The stomata of this form are unusually large, indicating that it may have more than 20 chromosomes. MONGOLIA: Gebiisk Altai and Dundu Saikhan, *Ikonnikov-Galitzky* 4064 (Lenin).

Subsp. *diversifolia*, RACE 12. Closely resembling the typical, tetraploid form, but leaf-lobes linear as in *altaica*; involucre only 10 to 11 mm long; dimensions of florets as in *diversifolia*, but achenes, though brown, only 5 mm long, and not beaked. SIBERIA: Altai, Lower Uiman Cliff, *Vereshchagin* 276 (Lenin).

#### UNCLASSIFIED SPECIMENS

The following specimens were seen before the present taxonomic treatment of this species had been worked out. Some of those from the region of *typica* may belong in that subspecies and some from the Altai region may be *altaica*, but probably most of them are representatives of apomictic races. SIBERIA: Amur, *Korshinsky* in 1891 (US); Yakutsk, along Angara River, *Patrin?* in 1783 (DL); Dahuri (= Transbaicalia), *Fischer* in 1822 (DC, DL); Irkutsk, Sajon Mountains, upper Irkut and Oka Rivers, *Komarov* in 1902 (B). MONGOLIA: mountains, 2000 m alt., *Chaff* 872 (P); Khan-gai Mountains, near Zany-gechen, summit of Halzan-dala, *Pavlov* 1359 (Mosc), (see fig. 12, *a-h*); Ulba River, near Ulbinskoi, *Karelin and Kirilloff* 884 (B). TURKESTAN: Ustan-sary, Vairam, *Fetissow* in 1878 (K); Pamir, Thian Shan Mountains, *Appleton* in 1906 (K). TIBET: Balti Province, Hushe via Haldi to Tshorkonda, *Schlanginweit* in 1856 (P).

#### RELATIONSHIP AND ORIGIN

*Y. tenuifolia* shows closest resemblance to *Y. Pratti* and *Y. Henryi* in the pinnately parted leaves with narrow segments; but neither of these species has the crested involucre bracts which are so characteristic of *tenuifolia*, occurring, as they do, constantly in all forms, although much reduced or absent on some heads in polyploid race 7. Also there are many other differences in morphological details between these species and *tenuifolia*. But no other species of *Youngia* appear to be as closely related to *tenuifolia* as these two. Hence the polyploid forms of *tenui-*



*folia* must have originated from the diploid subspecies described above (*typica* and *altaica*) or from similar diploids which have not yet been discovered. It is necessary to assume that at least one other diploid has been involved in the origin of the Himalayan "tetraploids," because they are characterized by large brown achenes which are unknown in *altaica* and *typica*.

The phyletic relations of the diploid subspecies with other species of *Youngia* are more obscure. Too little is actually known about chromosome number and morphology in this genus to warrant any hypotheses based on cytological evidence. If the diploid subspecies of *tenuifolia* are 5-paired, one could assume that they represent a connecting link between *Youngia* and *Crepis*, a hypothesis supported by their morphological characteristics.

## SECTION 5. MESOMERIS

### RELATIONSHIPS OF THE SPECIES

The eleven species in this section may be conveniently and more or less naturally arranged in three groups, as follows: (1) *cineripappa*, *fuscipappa*, and *gracilis*; (2) *paleacea*, *lanata*, *fusca*, and *Mairei*; (3) *Wilsoni*, *Henryi*, *terminalis*, and *Pratti*.

The species in the first group are set apart from all the others in this section by their pigmented pappus. The sinuate leaf-margin is another common characteristic, but this occurs to a less marked degree in other species. On the basis of size of the plant and of the caudical leaves, these three species form the series stated above when arranged in descending order. But this may not represent the phyletic relations of the species, for some of the morphological evidence does not support this concept. The size of the cauline leaves is inconsistent, the cauline leaves being much more reduced in *fuscipappa* than in either of the others. The shorter anthers and appendages in *cineripappa* is another inconsistency with the assumed order. The differences with respect to presence or absence of crests on the inner involucre bracts are of doubtful significance. In *cineripappa* the bracts are plane; in *fuscipappa* they are obscurely winged; and in *gracilis* they are definitely winged or crested. This may or may not support the seriation suggested above, according to one's concept of the homology of the crest. If the wing or claw is a specialized structure, then *gracilis* is the most advanced of the three species in this respect. But if it is a vestige remaining from the fusion of bracts, the situation is reversed. The geographic distribution of the three species, however, supports the idea that *cineripappa* is more primitive than the other two, for it occupies a central position with reference to the range of the genus, while the other two are at the outskirts of its range, *gracilis* on the west and *fuscipappa* far south of all other species in the genus, except probably *cineripappa* (cf. p. 62) and the ubiquitous tropical weed *Y. japonica*. Both *Y. gracilis* and *Y. fuscipappa*, therefore, are probably derived from an ancestral stock close to *Y. cineripappa*.

The four species in the second group, *paleacea*, *lanata*, *fusca*, and *Mairei*, are similar in gross morphology and in habit. Also they are all



more or less pubescent, with the same type of indumentum, and they all have crested inner involucral bracts. The most outstanding difference is found in the larger size and the polymorphism of *Y. paleacea*, which comprises three subspecies. The somatic chromosome number of one of these subspecies is 32, and from the morphology of the chromosomes it appears to be an amphidiploid. Two of the other three species, *lanata* and *Mairei*, are probably diploids, judging from the small size of the stomata on the caudical leaves of *lanata* and from the fact that in *Mairei* the heads, florets, and achenes are even smaller than in *lanata*. It is possible that these two species are the parents of *paleacea*, since they are sufficiently similar to *paleacea* and the differences between them might explain some of the variations found among the forms of *paleacea*. The fourth species, *fusca*, has somewhat larger stomata than *lanata*, which may indicate that it is a tetraploid. It most nearly resembles *lanata*, but it could hardly be an autotetraploid form of that species. Until more is known about the chromosomes of these species, further speculation concerning their relationships would be useless.

The third group, *Wilsoni*, *Pratti*, *Henryi*, and *terminalis*, have the common characteristic of being completely glabrous, except on such inconspicuous parts as the corolla-tube or the inner face of the involucral bracts. Also they all lack crests on the involucral bracts. In habit and leaves, however, they are more diverse than the species of the other two groups. *Y. Wilsoni* is intermediate between the two groups in form of the leaves, but the linear-caudate terminal lobe and acuminate lateral lobes indicate closer affinity with *Pratti* and *Henryi*. In *Y. Pratti* also the early caudical leaves are oblanceolate and runcinate, but the cauline leaves are strongly pinnately parted as in *Henryi*. In flowers and fruits *Wilsoni* shows more resemblance to *paleacea* than to the other members of its group. Hence it is clearly a connecting species between the two groups. In *Pratti* and *Henryi* the flowers and fruits are very similar, although there are plenty of minute differences. But the most striking difference between them is found in the shape of the early caudical leaves, which are narrowly oblanceolate in *Pratti* and broadly ovate in *Henryi*. It is by these peculiar juvenile leaves of *Henryi* that its relationship to *terminalis* is most strikingly shown. Reduction of the cauline leaves has been accomplished in *Henryi* by means of the pinnately parted pattern with narrow segments, whereas in *terminalis* it has been reached by extreme reduction in size of the leaves. The flower-heads and achenes are similar in the two species except for minor differences such as size and shape of the anther-appendages. These two species appear to have similar ecological relations, since in both of them the roots of herbarium specimens are imbedded in moss, and the leaves of *Henryi* are thin and flaccid. In this respect they appear to differ from both *Pratti* and *Wilsoni*.

#### 9. *Youngia cineripappa* (Babcock) comb. nov. (Fig. 13)

Perennial, 45 to 100 cm high, with rhizomate rootstock bearing fleshy fibers; caudex short, leafy, 1- to 2-stemmed; caudical leaves 4 to 12, up to 25 cm long, 4.5 cm wide, semierect, obovate or oblanceolate, obtuse

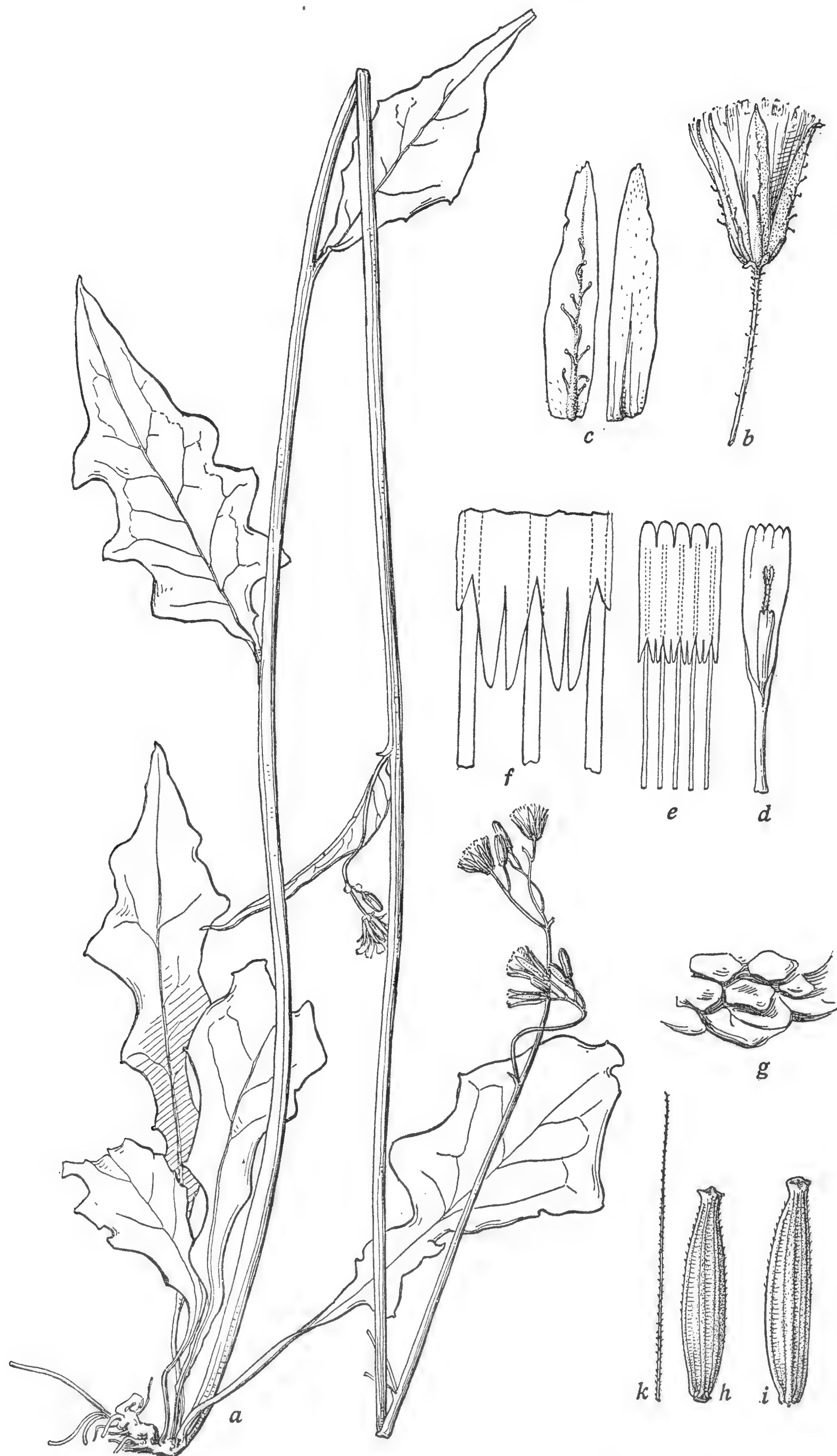


FIG. 13—*Youngia cineripappa*, *a*, *b*, *d*–*f*, from cotype (US 458770); *c*, *g*–*k*, from type (NY): *a*, plant,  $\times \frac{1}{2}$ ; *b*, head,  $\times 4$ ; *c*, inner involucral bract, dorsal and ventral sides,  $\times 4$ ; *d*, corolla,  $\times 4$ ; *e*, anther-tube,  $\times 8$ ; *f*, detail of appendages,  $\times 32$ ; *g*, detail of receptacle,  $\times 20$ ; *h*, *i*, *k*, marginal and inner achenes and pappus-bristle,  $\times 8$ .

or acute, margins very narrowly retrorsely revolute, coarsely sinuate-runcinate or -dentate, papillose-mucronate, tapering gradually into a winged petiole  $\frac{1}{4}$  to  $\frac{1}{2}$  as long as the blade, with broader clasping base, glabrous above, fuscous-tomentulose below especially along the veins; cauline leaves 4 to 7, lower similar to caudical ones or sessile and acuminate, intermediate entire, uppermost linear, bractlike; stem erect, straight, terete, striate, fuscous-tomentose at nodes and base, gland-pubescent above, branched only near top, the short branches bearing few or several heads in a small congested cluster, terminal portion of aggregate inflorescence a dense few-headed simple or compound panicle; peduncles 2 to 12 mm long, slender, fuscous-tomentose and gland-pubescent with short thick hairs and oblate or ellipsoidal brown glands; heads erect, small, about 15-flowered; involucre cylindrical, 7 to 8 mm high, gland-pubescent; outer involucral bracts 5 to 6, about 1 mm long, 0.5 mm wide, acute,  $\pm$  scarious; inner bracts 8, lanceolate, obtuse or acute, innermost membranous-margined, ventrally pubescent with short white hyaline appressed hairs, dorsally becoming carinately spongy-thickened, ultimately reflexed; receptacle areolate, with low fimbriæ, naked interspaces, slightly elevated scars and central stipes; corolla 8 to 9 mm long; ligule 1 mm wide; teeth 0.25 mm long, triangular; corolla-tube 4 mm long, narrow, sparsely pubescent with spreading white hyaline hairs; anther-tube dark green, about  $2 \times 1.25$  mm dis.; appendages about 0.2 mm long, acuminate; style-branches 0.7 mm long, yellow; achenes brown, pale near summit, 3.5 mm long, 0.6 to 0.8 mm wide, fusiform, more attenuate toward summit, with slightly expanded pappus-disk and narrow yellow basal callus surrounding the hollow base, marginal ones dorso-ventrally compressed, about 12-ribbed, with 1 stronger median rib on ventral face and 2 stronger ribs on dorsal face, inner ones 4-angled by the stronger ribs, finely spiculate; pappus pale inky gray en masse, 4 to 5 mm long, of 1 series of fine soft barbellulate bristles, persistent. Flowering April to June; flowers yellow, anther-tube green, style-branches yellow. (*Crepis primulifolia* Hook. f., ex Benth. et Hook. f., Gen. Pl. 2(1):514, 1873, as nomen nudum; *Crepis cineripappa* Babcock, in Univ. Calif. Publ. Bot. 14:325, 1928.)

China, in southeastern Yunnan and southeastern Szechwan at elevations of 1000 to 1500 m and probably in Kweichow; Indo-China, Assam, and eastern India from 1200 to 1800 m alt. Probably to be found at similar elevations in northern Burma. One typical fragment, lacking caudex and root, is labeled as from the highlands of Ceylon. This may indicate a considerable gap in distribution, but the region between Khasia and Ceylon is at present unsuited to this species (cf. "Relationship").

CHINA: Yunnan, Szemao, *Henry 11997* (NY, US 458770, Mo 91186), *type* and cotypes; *ibid.*, Meng-tsze, old wood on side of a mountain, *Henry 10680A* (NY, US, Mo); *ibid.*, Meng-tsze, dry sandstone gully of (Sheentet?), *Henry 13678* (US); *ibid.*, Meng-tsze?, Sheentet, *Henry* (NY); Szechwan, Kikiang Hsien, 1000 to 1300 m alt., *Fang 1306* (B, US). INDO-CHINA: Tongking, Chapa, 1400 m alt., *Petelot 1762* (UC). ASSAM and EASTERN INDIA: Shillong (Khasi Hills), 1360 m alt., *C. B. Clarke 43477C* (Fl); "Khasia" (=Khasi and Jaintia Hills district?), 1200 to 1800 m alt., *Hooker f. and Thomson*, as *Crepis?* (K, G).

This species is very variable in degree of indentation of the leaves, and it happens that in the plants from the Khasi hills the leaves are merely denticulate to shallowly dentate, whereas the plants from Indo-China and Yunnan are more coarsely toothed. But the material from southern stations is very limited, and other plants from that region may be strongly dentate. At any rate the difference noted is merely one of degree in otherwise similar leaves.

#### RELATIONSHIP

Close to *Y. fuscipappa* and *Y. gracilis*, but very distinct from both in the rhizomate rootstock, broad leaves, indumentum of stem and heads, elevated areolæ of receptacle, size of anther-tube, color of style-branches, color and shape of achenes. From the morphological evidence *Y. cineripappa* may be the most primitive of the three species, and it occupies a position nearest the center of the range of the genus. If its existence in Ceylon is eventually verified, this will strengthen the evidence either that this species is the ancestor of the other two or that it represents a common progenial stock.

#### 10. *Youngia fuscipappa* Thwaites, Enum. Pl. Zeyl. 168, 1864. (Fig. 14)

Perennial, 30 to 45 cm high; caudex slender, woody, leafy or scaly below with bases of old leaves, simple or divided, 1- to 5-stemmed, stoloniferous or reproducing from root-sprouts; caudical leaves up to 18 cm long, 1.8 cm wide, erect, oblanceolate, acuminate, coarsely sinuate-dentate or subpinnatifid, segments remote, broad, rounded, finely mucronate, attenuate into a narrow winged petiole  $\frac{1}{4}$  to  $\frac{1}{2}$  as long as leaf and broader at base, puberulent or glabrescent, margin finely retrorsely revolute; cauline leaves linear or bractlike; stems erect, slender, sinuate, glabrous, remotely branched from near base or above middle, branches divaricately arcuate or strictly dichotomous, cymosely 2- to 8-headed; peduncles 0.7 to 9 cm long, very slender, fuscous-tomentulose; heads erect, small, 11- to 14-flowered; involucre cylindric, 7 to 8.5 mm high, glabrous; outer involucre bracts 5, ovate, obtuse, 1 to 2 mm long; inner bracts 8, lanceolate, acute, inner scarious-margined, glabrous or sparsely appressed-pubescent within, dorsally median-nerved, nerve more prominent or narrowly winged near tip, becoming thickened or carinate toward base in fruit, ultimately reflexed; receptacle areolate, naked; corolla 9 to 10 mm long; ligule 1.3 to 1.5 mm wide; teeth 0.6 to 0.8 mm long, conspicuously gland-crested; corolla-tube 2.5 mm long, densely pubescent with 2-celled acicular hairs up to 0.15 mm long; anther-tube about  $2.75 \times 1$  mm dis.; filaments extend beyond appendages 0.75 mm; appendages 0.75 mm long, narrow, acuminate, united; style-branches 1.25 to 1.5 mm long, 0.1 mm wide, green; achenes very dark brown, 3.5 mm long, 0.7 mm wide, subcompressed, fusiform, more strongly attenuate to the narrow summit, with slightly expanded pappus-disk, less attenuate to the lightly calloused hollow base, about 14-ribbed, ribs unequal with 4 to 5 stronger, rounded, finely spiculate; pappus brownish yellow or pale tawny, 4 mm long, 2-seriate, bristles unequal, inner ones coarser, united at base,



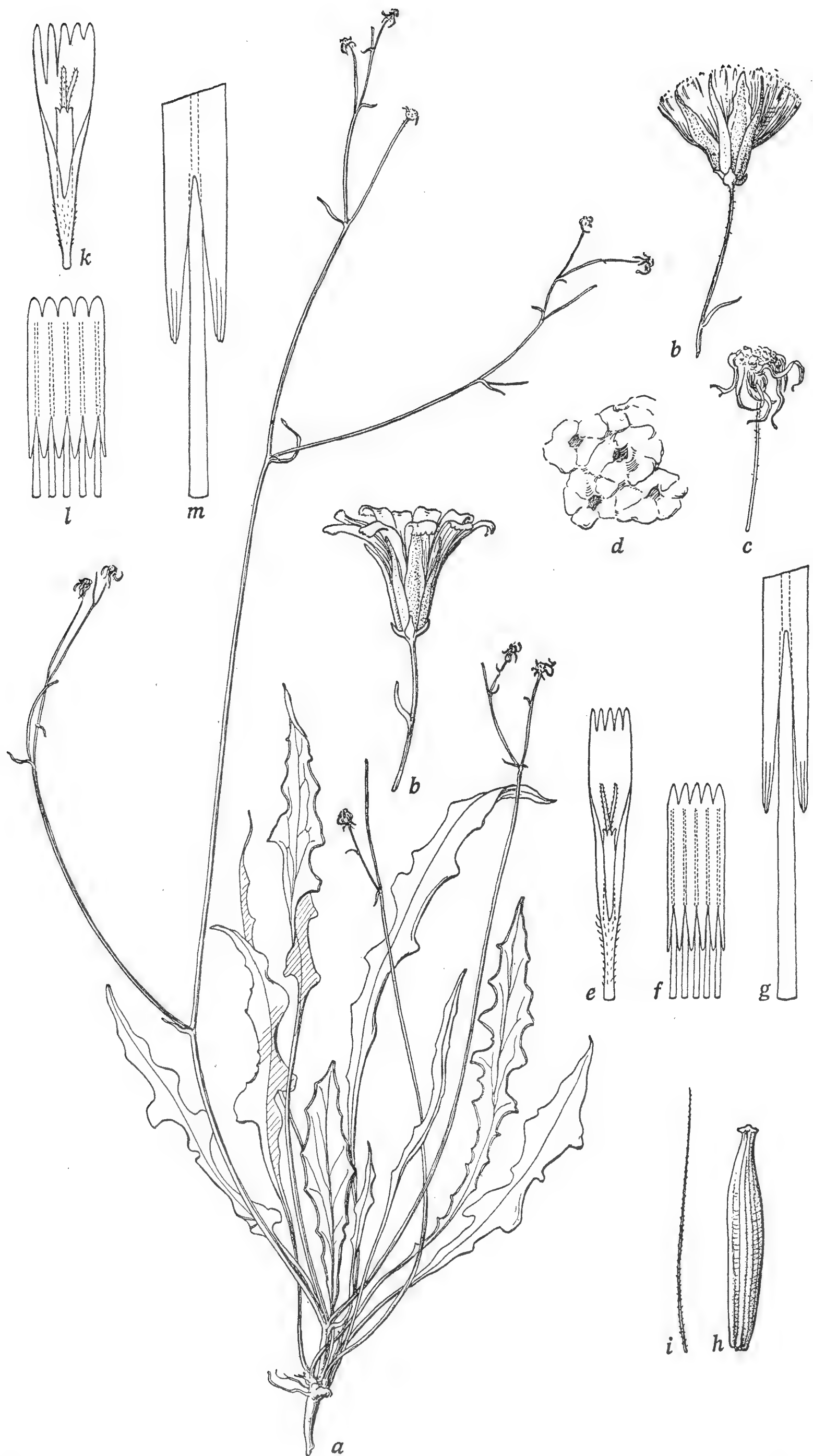


FIG. 14—*Youngia fuscipappa*, *a-i*, from cotypes (G); *k-m*, from Simpson in 1932 (UC 476318): *a*, old plant,  $\times \frac{1}{2}$ ; *b*, head and peduncle,  $\times 2$ ; *c*, old head,  $\times 2$ ; *d*, detail of receptacle,  $\times 20$ ; *e*, floret lacking ovary,  $\times 4$ ; *f*, anther-tube,  $\times 8$ ; *g*, detail of appendages,  $\times 32$ ; *h*, *i*, achene and pappus-bristle,  $\times 8$ ; *k*, floret lacking ovary,  $\times 4$ ; *l*, anther-tube,  $\times 8$ ; *m*, detail of appendages,  $\times 32$ .

barbellulate, persistent. Flowering April to May; flowers yellow, anther-tube yellow, green at summit, style-branches green (black *in sic.*). (*Crepis fuscipappa* Benth. et Hook. f., Gen. Pl. 2(1):254, 1873; C. B. Clarke, Comp. Ind. 254, 1876.)

Ceylon, in highlands. Type collection from Central Province at an elevation of 1500 m. Cultural experiments have shown that it grows best in shade. From the few herbarium specimens seen it appears that this is an extremely variable species, not only in pappus color but in other characters of the flowers and fruits (cf. form 1 below).

INDIA: Ceylon, Central Province, 1515 m alt., *Thwaites 1748* (G), cotypes; Hakgala, *Simpson* in 1932 (UC 476318), form 1; without definite locality, 2530 m alt., *Hosseus 74* (Mu).

#### NUMBERED FORM

1. *YOUNGIA FUSCIPAPPA*, but achenes smaller, pappus very pale, and ligule-teeth extremely variable; corolla 8 mm long; ligule 2 mm wide; teeth 0.5 to 2 mm long, gland-crested; corolla-tube 2.25 mm long, pubescent with 2-celled acicular hairs up to 0.15 mm long; anther-tube about  $2.5 \times 1.2$  mm dis.; filaments extend beyond appendages 0.5 to 0.75 mm; appendages 0.7 mm long, narrow, acuminate, united; style-branches 1.25 mm long, 0.15 mm wide, green; achenes 2.75 to 3.25 mm long, 0.5 mm wide; pappus 4 to 5 mm long, very pale tawny. *Simpson* in 1932 (UC 476318), Hakgala, Ceylon. (Fig. 14, *k-m.*)

#### RELATIONSHIP

Close to *Y. gracilis* and *Y. cineripappa* but distinct from both in the narrow, glabrescent leaves, and in various characters of flowers and fruits.

11. *Youngia gracilis* Hook. f., ex Benth. et Hook. f., Gen. Pl. 2(1):514, 1873, as nomen nudum. (Fig. 15)

Perennial, 24 to 40 cm high, with short præmorse rootstock and strong branched secondary roots; caudex very short, leafy; caudical leaves 4 to 6, up to 4 (8?) cm long, 2 cm wide, semierect, oblanceolate, acute, margin rather strongly retrorsely revolute, sinuate-runcinate or -dentate, lateral segments or teeth mostly papillose-mucronate, tapering into a very short winged petiole with clasping base, finely pubescent on both sides with short piliform several-celled trichomes and a few stouter ones on margins and lower side of midrib, paler beneath; cauline leaves 6 to 8, mostly similar to radical ones or acuminate, uppermost linear, bractlike; stem very slender, erect, sinuate or zigzag with the angles at the nodes, terete, striate, glabrous or tomentulose at nodes, unbranched or branched near top or at each node, the short (3 to 7 cm) branches bearing 1 to 8 heads in a close corymb; peduncles 1 to 1.5 cm long, glabrous; heads rather small, half-nodding, about 15-flowered; involucre cylindrical, 8 to 9 mm high, glabrous; outer involucral bracts 6 to 7, about 1 mm long, 1 mm wide, ovate, dark green; inner bracts 8, lanceolate, acute or obtuse, scarious-margined, ventrally glabrous, with a darker dorsal median rib, rib in outer series of inner bracts thickened toward tip, crested or alate with a wing about 1 mm long, becoming carinately spongy-thickened at maturity; receptacle areolate, naked; corolla 8 mm long; ligule 5.5 mm long; teeth 1 mm long, narrow, acute, gland-tipped; corolla-tube 2.5 mm

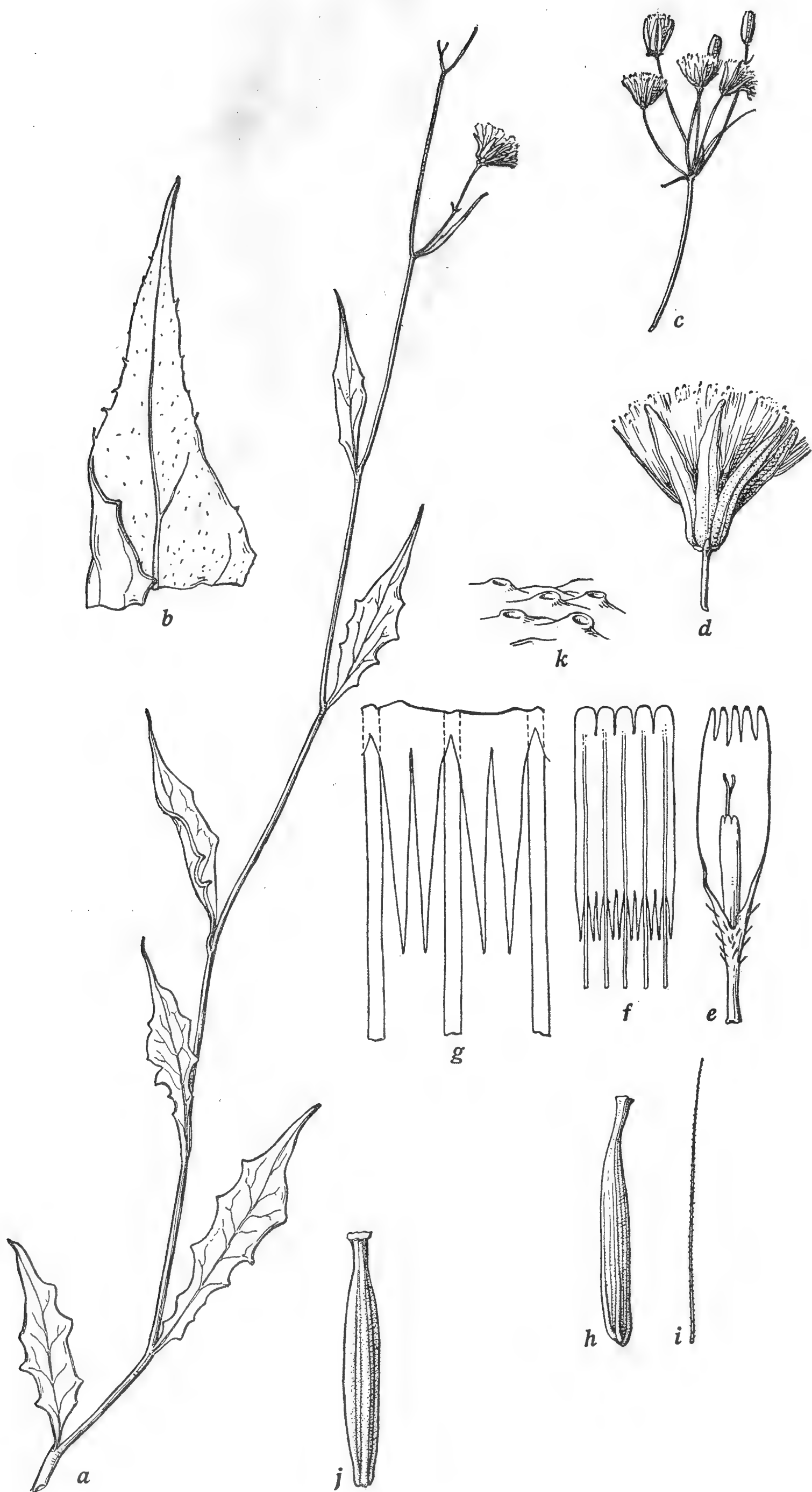


FIG. 15—*Youngia gracilis*, *a-i*, from type (G) and cotype (NY); *j-k*, from *Prain's Collector 333* (Po 10571): *a*, plant,  $\times \frac{1}{2}$ ; *b*, apical part of leaf,  $\times 2$ ; *c*, 1 of 2 nearly equal branches from top of plant,  $\times \frac{1}{2}$ ; *d*, head,  $\times 2$ ; *e*, floret lacking ovary,  $\times 4$ ; *f*, anther-tube,  $\times 8$ ; *g*, detail of appendages,  $\times 32$ ; *h*, *i*, *j*, achenes and pappus-bristle,  $\times 8$ ; *k*, detail of receptacle,  $\times 25$ .

long, sparsely pubescent with short white spreading hairs; anther-tube green,  $3 \times 1.25$  mm dis.; appendages 0.5 mm long, acuminate; style-branches about 1 mm long, dark brown or green; achenes brownish purple with yellow summit and pappus-disk, about 4 mm long, narrow, fusiform, subcompressed, rather strongly attenuate toward the narrow (0.2 to 0.3 mm wide) summit below the slightly expanded pappus-disk, somewhat narrowed to the hollow base, about 15-ribbed, ribs unequal, 2 or 3 stronger ones, rounded, finely spiculate; pappus inky gray en masse, 4 to 5 mm long, of 1 series of rather coarse barbellulate bristles, persistent. Flowers yellow, anther-tube green, style-branches brown or green. (*Crepis gracilis* Hook. f. et Th., ex C. B. Clarke, Comp. Ind. 254, 1876, non (D. C. Eaton) Rydb.; *Crepis atripappa* Babcock, in Univ. Calif. Publ. Bot. 14:324, 1928.)

HIMALAYAS: Sikkim, 3000 to 3600 m alt. (type locality), *Hook. f. and Thomson* (G type, NY, Fl cotypes); Sikkim, below Tangu, 3030 m alt., *Smith and Cave 2296* (Calcutta); Sikkim, Lachin, *Prain's Collector 333* (Po), form 1.

#### NUMBERED FORM

1. *YOUNGIA GRACILIS*, but leaves glabrous; peduncles of fruiting heads prominently striate; involucre bracts becoming spongy-thickened at base; receptacle faintly areolate, the areoles centrally pitted. *Prain's Collector 333* (Po 10571), Sikkim, Lachin, Himalaya. (Fig. 15, j, k.)

#### RELATIONSHIP

Close to *Y. fuscipappa* and *Y. cineripappa* but very distinct from both in the præmorse rootstock, in size and indumentum of leaves, in the definite wing or crest on outer series of inner involucre bracts, in length of corolla-teeth, size of anther-tube and appendages, and the more attenuate achenes.

#### 12. *Youngia paleacea* (Diels) comb. nov. (Figs. 16–18)

Perennial, 20 to 70 cm high; taproot slender, woody, vertical or oblique; caudex 0.5 to 1 cm wide, brown with bases of old leaves or leafy; caudical leaves ascending, oblanceolate, mostly acute or acuminate, dentate to runcinate-pinnatifid, segments papillose-mucronate, margin retrorsely revolute, attenuate into a winged petiole,  $\pm$  pubescent on both sides with crinkled pale-brownish many-celled piliform trichomes; cauline leaves few, remote, short-petioled or sessile, lanceolate-acuminate, linear or bractlike; stem erect, slender, terete, tomentulose or glabrous, forked or branched at or near base or remotely branched above, branches strict or arcuate, shorter than axis, aggregate inflorescence paniculate or corymbiform; peduncles 0.4 to 3 cm long, slender, becoming sulcate, slightly thickened near head in fruit, canescent-tomentulose; heads erect, medium, 9- to 16-flowered; involucre 9 to 13 mm long, cylindric, dark green, glabrous; outer involucre bracts 5 to 9, ovate to lanceolate, acute or obtuse, 1 to 3 mm long; inner bracts 8 to 9, lanceolate, acute, in 2 series, inner series membranous-margined, outer series crested with a small, sometimes obscure, wing or claw near tip, becoming carinate, spongy-thickened near



base in fruit, ventrally pubescent with very short appressed shining hairs; receptacle areolate, glabrous; corolla deep yellow tinged with reddish purple on outer face of ligule, teeth purple; anther-tube green, pollen yellow; style-branches yellow or sometimes reddish brown *in sic.*; achenes  $\pm$  compressed, unequally ribbed,  $\pm$  spiculate; pappus white, equal to or exceeding involucre, barbellulate, united at base, persistent. Flowering July to September.

China, in western Yunnan, western and northern Szechwan, cool temperate mountain regions from 2700 to 3900 m alt., in open meadows, margins of forests, and near plantations.

This species, from the limited material available, appears to be a complex of polyploid forms derived from an amphidiploid hybrid. Although some rather well-marked entities are indicated by the limited collections, yet these are so similar in most characters and so variable within themselves that a conservative treatment is needed. They are accordingly recognized as subspecies, of which *typica* appears to represent the original amphidiploid, since one accession is known to have 32 chromosomes in the somatic cells, whereas comparative stomatal and pollen-grain measurements indicate that the other two subspecies are higher polyploids.

#### SUBSPECIES

##### KEY TO THE SUBSPECIES OF YOUNGIA PALEACEA

Corolla 12 to 15 mm long; achenes dark brown or blackish.

Achenes slightly attenuate, constricted at summit, not beaked, marginal dorsoventrally compressed . . . . . *a. typica*

Achenes strongly attenuate into a short coarse beak, marginal laterally compressed . . . . . *b. yunnanensis*

Corolla 17 to 22 mm long; achenes light reddish or yellowish brown, variable in shape . . . . . *c. Smithii*

**12a. *Youngia paleacea typica* nom. nov.**—Plant 30 to 70 cm high; caudical leaves up to 18 cm long, 3.5 cm wide, petiole  $\frac{1}{4}$  to  $\frac{1}{2}$  as long as leaf; heads 10- to 16-flowered; involucre 10 to 12 mm long; corolla 12 to 14 mm long; ligule 1.5 mm wide, teeth 0.5 to 0.6 mm long, conspicuously glandular at tip, hooded; corolla-tube 3 to 4 mm long, sparsely pubescent with very short hairs; anther-tube about  $5 \times 1.25$  mm dis.; filaments extend beyond appendages about 1 mm; appendages 1 to 1.25 mm long, oblong, obtuse, united; style-branches 1.8 to 2 mm long, 0.1 to 0.15 mm wide; achenes dark brown or nearly black except the paler summit, 3.5 to 4 mm long, 0.75 mm wide, shortly attenuate to the narrow (0.3 mm wide) summit, with slightly wider pappus-disk, abruptly narrowed at the calloused hollow base, 12- to 14-ribbed, ribs narrow, rounded, with 3 to 4 stronger ones; pappus 5 to 7 mm long, 2-seriate. Chromosomes,  $2n=32$ . (*Crepis paleacea* Diels, in Notes Roy. Bot. Gard. Edinb. 25:202, 1912.) (Fig. 16.)

The type (E) is the first specimen cited. The name is unfortunate because the trichomes on the leaves are hairlike, not palea-like, and the receptacle is naked. Although mature achenes are lacking in the type, the cotype at Paris has half-mature fruits which agree with the specimens of Handel-Mazzetti cited below. The latter are from the same region as the type and they agree so closely in other characters as to insure

their identity. Rock's earlier specimens are also from the type region, but they too lack mature achenes. However, seeds collected later by Rock (no. 23472) have produced garden plants typical of the species and bearing typical achenes (see below).

CHINA: northwestern Yunnan, eastern flank of Likiang Range, 27° 20'N., 2727 to 3333 m alt., margins of pine forests, *Forrest* in 1906 (E, P); *ibid.*, near Tibetan border, 28°15'N., below Mount Dokerla, *Handel-*

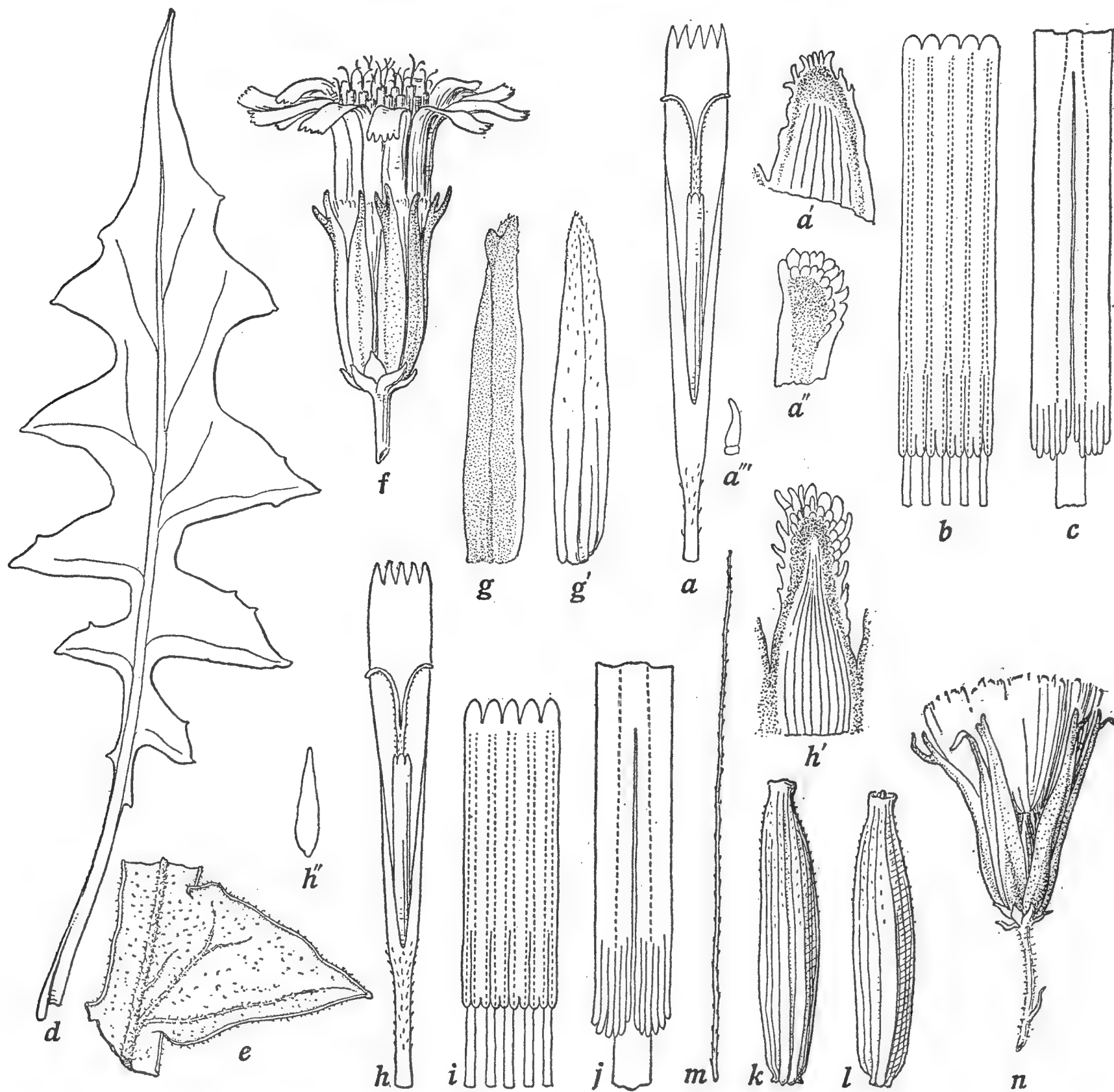


FIG. 16—*Youngia paleacea typica*, a-c, from type (E); d, e, k-n, from *Handel-Mazzetti* 8055 (UC 259879); f-j, from *Soulié* 2165 (B): a, floret lacking ovary,  $\times 4$ ; a', a'', ventral and lateral views of ligule-teeth,  $\times 25$ ; a''', trichome from corolla-tube,  $\times 50$ ; b, anther-tube,  $\times 8$ ; c, detail of appendages,  $\times 32$ ; d, lower cauline leaf, upper side,  $\times 1$ ; e, part of another leaf, lower side,  $\times 2$ ; f, head,  $\times 2$ ; g, g', inner involucral bracts, dorsal and ventral sides,  $\times 4$ ; h, floret lacking ovary,  $\times 4$ ; h', ligule-tooth,  $\times 25$ ; h'', trichome from corolla-tube,  $\times 50$ ; i, anther-tube,  $\times 8$ ; j, detail of appendages,  $\times 32$ ; k, l, m, achene and a pappus-bristle,  $\times 8$ ; n, nearly mature head,  $\times 4$ .

*Mazzetti* 8055 (MW, UC); *ibid.*, near Chungtien district, *Handel-Mazzetti* 7717 (MW, UC); *ibid.*, Yangtze watershed, eastern slopes of Likiang Snow Range, *Rock* 5642, 5238, 5354 (US); Yunnan-Tibet (Tsarung) border, Yundshi Mountain, *Rock* 23472 (UC); *ibid.*, western range of Mekong, *Rock* 23060 (UC, US); Szechwan, Tatsienlu, *Soulié* 625, 866 (K); *ibid.*, Tatsienlu, *Soulié* 2165, 2166 (B); *ibid.*, Hwang-liang-dse

Mountains, 27°48'N., *Handel-Mazzetti* 5501 (MW); *ibid.*, Sungpan Hsien, *Fang* 4468 part (US).

12b. *Youngia paleacea yunnanensis* (Babcock) comb. nov.—Plant 20 to 60 cm high; caudical leaves up to 13 cm long, 3 cm wide, petiole  $\frac{1}{8}$

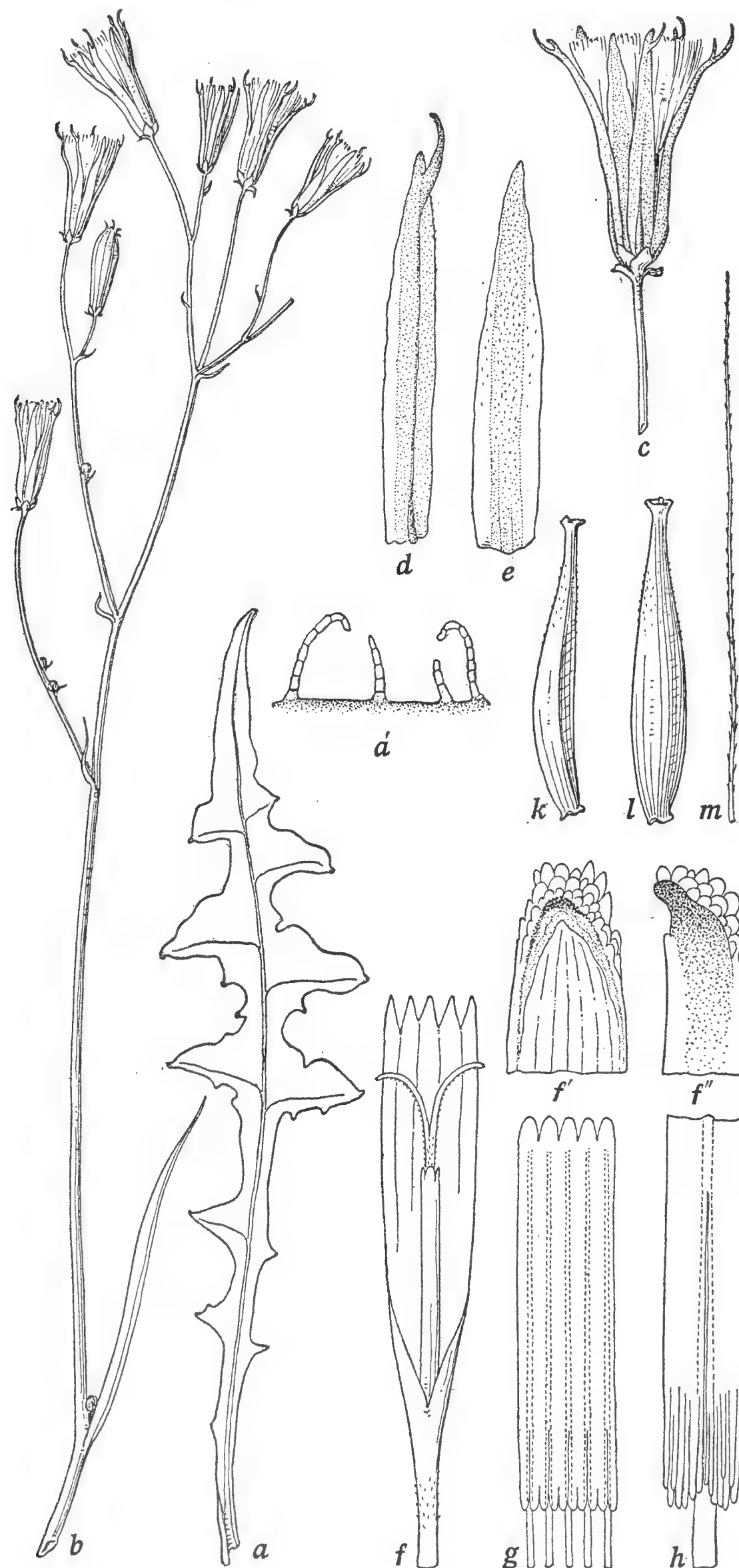


FIG. 17—*Youngia paleacea yunnanensis*, from type sheet (K): a, lower cauline leaf,  $\times 1$ ; a', detail of pubescence from margin of leaf,  $\times 50$ ; b, upper part of one stem,  $\times 1$ ; c, nearly mature head,  $\times 2$ ; d, e, inner involucre bracts,  $\times 4$ ; f, floret lacking ovary,  $\times 4$ ; f', f'', details of ligule-teeth,  $\times 25$ ; g, anther-tube,  $\times 8$ ; h, detail of appendages,  $\times 32$ ; k, l, m, achenes and a pappus-bristle,  $\times 8$ .

to  $\frac{1}{2}$  as long as leaf; heads 9- to 13-flowered; involucre 10 to 13 mm long; corolla 14 to 15 mm long; ligule 2.4 mm wide; teeth 0.4 to 0.8 mm long, conspicuously glandular at tip, hooded; corolla-tube 4 mm long, shortly pubescent or glabrous; anther-tube 5 to  $6.25 \times 1.25$  to 1.5 mm dis.; filaments extend beyond appendages about 1 mm; appendages 1 to 1.5 mm long, oblong, obtuse or acute, united; style-branches 2.2 to 3 mm long, 0.15 mm wide; achenes deep reddish brown with paler summit, 3 to 4 mm long, 0.6 mm wide, fusiform or ventrally straight and dorsally convex, strongly attenuate to the narrow (0.2 to 0.3 mm wide) summit, with expanded pappus-disk, abruptly attenuate to the narrow (0.3 mm wide) base above the flaring callus enclosing the yellow hollow base, 15- to 17-ribbed, ribs narrow, rounded, with 3 to 4 stronger ones; pappus 6 to 7 mm long, 1- to 2-seriate. (*Crepis yunnanensis* Babcock, in Univ. Calif. Publ. Bot. 14:332, 1928.) (Fig. 17.)

CHINA: Yunnan, between the Yangtze and Chungtien Rivers, alpine meadows, *Schneider* 2181 (K), type; *ibid.*, Tong Tchouan (Tungchwan?), 1800 m alt., *R. P. Maire* 4002 (UC); *ibid.*, Likiang district, eastern slopes of Likiang Snow Range, *Rock* 5354 (B), form 1; *ibid.*, without definite locality, *E. E. Maire* 2601, 7325 (UC); Szechwan, Sungpan Hsien, *Fang* 4468 part (B).

12c. **Youngia paleacea Smithii** subsp. nov.—Planta 27–46 cm alta; folia caudicalia tantum 14 cm longa, 3 cm lata, petiolus  $\frac{1}{5}$ – $\frac{2}{3}$  tamdiu folium; capitula circa 12-flora; involucrum 11–13 mm longum; corolla flava, 17–22 mm longa; antheræ virides, 5–8 mm longæ; stylus flavus, rami tantum 3 mm longi; achænia subrufa vel fusca, 3.5–4 mm longa, fusiformia, forte attenuati ad apicem; pappus albus, 7–9 mm longus.

Plant 27 to 46 cm high; caudical leaves up to 14 cm long, 3 cm wide, petiole  $\frac{1}{5}$  to  $\frac{2}{3}$  as long as leaf; heads about 12-flowered; involucre 11 to 13 mm long; corolla 17 to 22 mm long; ligule 2 to 2.5 mm wide; teeth 0.4 to 0.9 mm long, conspicuously gland-crested, hooded with small anterior protuberance; corolla-tube 3 to 7 mm long, sparsely pubescent with very short (up to 0.15 mm) stalked papilliform hairs; anther-tube 5 to  $8 \times 1.25$  mm dis.; filaments stout, extending beyond appendages about 1 mm; appendages up to 1.3 mm long, oblong, sagittate, united; style-branches up to 3 mm long, 0.15 mm wide, attenuate at tip, yellow; achenes light reddish or yellowish brown, 3.5 to 4 mm long, 0.6 mm wide, fusiform,  $\pm$  attenuate to the constricted or coarsely beaked summit (0.25 to 0.3 mm wide), with slightly expanded pappus-disk, abruptly narrowed near the calloused hollow base (0.3 to 0.4 mm wide), about 14-ribbed, ribs narrow, rounded, with 3 to 4 stronger ones; pappus 7.8 to 9 mm long, 2-seriate. (Fig. 18.)

The type, at Upsala, Harry Smith no. 4079a, has achenes shaped as in *typica*, but on the same sheet is another plant of which the achenes are more strongly attenuate or with a short coarse beak as in *yunnanensis*. This variability in achene shape occurs in Smith's other two collections cited below, no. 2219 consisting of three plants all with short-beaked fruits, while no. 2876 comprises three plants all with achenes shaped as in *typica*. Yet in the three collections the fruits are pale in color just as in the type of this subspecies, and this peculiarity is asso-



ciated with the larger florets and flower parts. This subspecies is known only from the Sung-pan region in northern Szechwan.

CHINA: northern Szechwan, Sung-pan, mountains about 15 km south, 3000 to 3200 m alt., *Harry Smith 4079* (Upsala), *a* = type; *ibid.*, Sung-pan region, about 3300 m alt., *Harry Smith 2219* (Upsala); *ibid.*, Sung-pan region, *Harry Smith 2876* (Upsala), form 2.

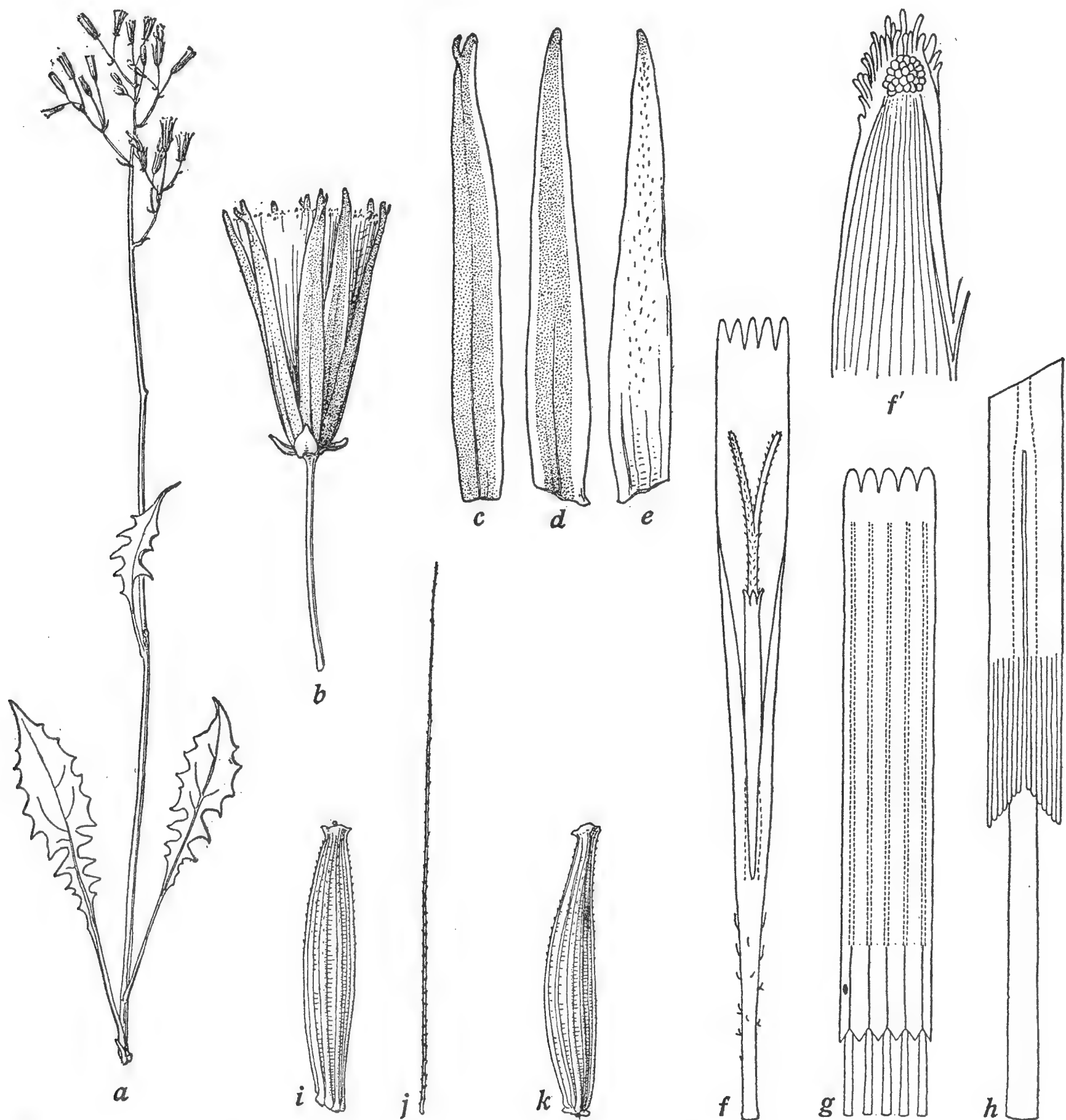


FIG. 18—*Youngia paleacea Smithii*, a–j, from type (Upsala); k, from cotype, *Harry Smith 4079a*, b (Upsala): a, plant,  $\times \frac{1}{4}$ ; b, fruiting head,  $\times 2$ ; c, d, e, inner involucral bracts, 2 dorsal, 1 ventral,  $\times 4$ ; f, floret lacking ovary,  $\times 4$ ; f', detail of ligule-tooth,  $\times 50$ ; g, anther-tube,  $\times 8$ ; h, detail of appendages,  $\times 32$ ; i, j, k, achenes and pappus-bristle,  $\times 8$ .

#### NUMBERED FORMS

1. *YOUNGIA PALEACEA YUNNANENSIS*, but caudical leaves long-petioled, sinuate-dentate, approaching those of the type of *Smithii*. *Rock 5354* (B), eastern slopes of Likiang Snow Range, Likiang district, Yunnan.
2. *YOUNGIA PALEACEA SMITHII*, but caudical leaves very short (up to 5 cm); branches very slender, elongate, pedunculate. *Harry Smith 2876* (Upsala), vicinity of Sung-pan, northern Szechwan.

VARIABILITY AND POLYPLOIDY

Polymorphism in this species is certainly associated with polyploidy. It probably indicates that subspecies *typica*, which is known to have 32 chromosomes as the somatic number in one collection, is an amphidiploid, derived from hybridization between two 8-paired species. Comparison of stomatal and pollen-grain sizes in herbarium specimens of the three subspecies and the two numbered forms indicates that *yunnanensis* and *Smithii* are hexaploids ( $2n = 48?$ ) but that forms 1 and 2 are octoploids ( $2n = 64?$ ). These data on long axis of guard cells on caudical leaves and diameter of pollen-grains, both measured in microns, are given in the accompanying table. The fact that in form 2 about 25 per cent of the pollen grains are 4-pored, while such grains are scarce in the other specimens, is further evidence that this form is a higher polyploid. Thus it appears that *Youngia paleacea* is an assemblage of polyploid forms, derived from an amphidiploid hybrid, and exhibiting definite tendencies toward specific differentiation. It is probable, therefore, that as future collections increase the herbarium representatives of this species, other anomalous forms and even additional subspecies will come to light.

Specimen	Size of stomata	Size of pollen-grains	Somatic chromosome number
	$\mu$	$\mu$	
<i>Typica:</i>			
Rock 23472 (living progeny) . . . . .	34 (31 cauline)	30	32
Handel-Mazzetti 8055 . . . . .	31 (cauline)	29	32?
Rock 18505 . . . . .	34	29	32?
Fang 4468 (US 1509716) . . . . .	.....	34	48?
<i>Yunnanensis:</i>			
Fang 4468 (B) . . . . .	.....	33	48?
Maire 4002 . . . . .	37	34	48?
Maire 7325 . . . . .	36	33	48?
Maire 2601 . . . . .	37	32	48?
Rock 5354 (form 1) . . . . .	40.5	35	64?
<i>Smithii:</i>			
Smith 4079 . . . . .	36	33	48?
Smith 2219 . . . . .	36	32	48?
Smith 2876 (form 2) . . . . .	41.5	34.5	64?

RELATIONSHIP

Two species which may have been involved in the original hybrid from which the amphidiploid progenitor of *paleacea* was derived are *Y. lanata* and *Y. Mairei*. This is indicated by the general morphology of the two species; and their differences in shape of achenes and size of florets would explain the variations in these characters which occur within *paleacea*. Data on stomatal size in *Y. lanata* support this hypothesis, since the average length of the stomata on caudical leaves is only 26  $\mu$  in *lanata* as compared with 34  $\mu$  in *paleacea typica*. The pollen-grains in *lanata* average about 29  $\mu$ , which is the same as *paleacea typica*. Data on stomata and pollen-grains in *Mairei* are lacking; but since its heads,

florets, and achenes are smaller than in *lanata*, it is fair to assume that *Mairei* is also a diploid with eight pairs. Geographic distribution is consistent with this hypothesis. It is possible, however, that there are other diploid species in the Yunnan region which may have been involved in the origin of *paleacea*.

13. *Youngia lanata* sp. nov. (Fig. 19)

Herba perennis, 9–28 cm alta; radix tenuis; caudex 4–7 mm latus, fuscus; folia caudicalia pauca, parva, scandentia, obovalia vel oblanceolata, petiolata, infra fusca et tomentosa, supra pubescentia; folia caulina

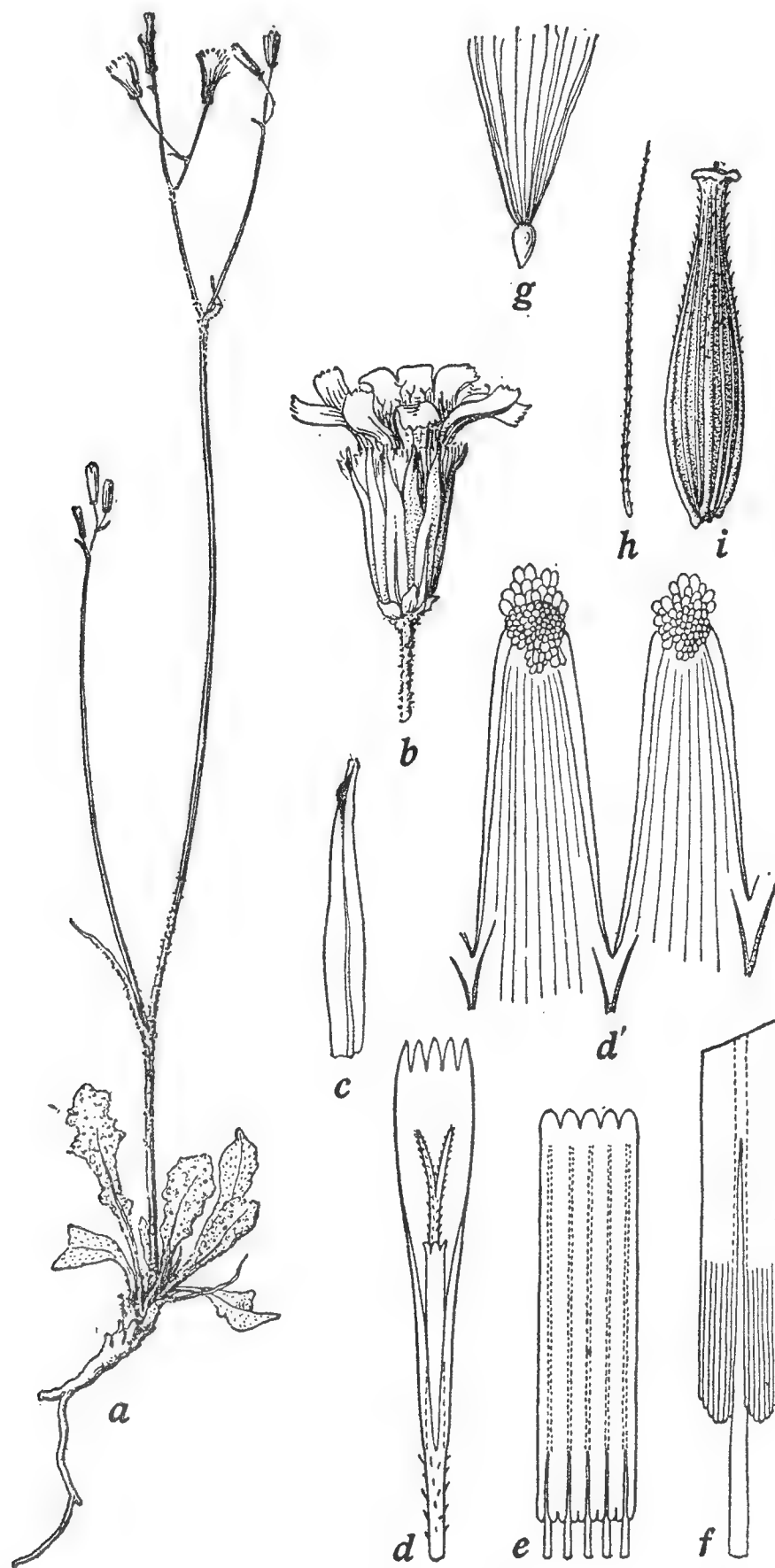


FIG. 19—*Youngia lanata*, a–g, from type (DL); h, i, from *Maire 2872* (UC 388604): a, whole plant,  $\times \frac{1}{2}$ ; b, head with all florets in anthesis,  $\times 2$ ; c, inner involucre bract, outer face,  $\times 4$ ; d, floret lacking ovary,  $\times 4$ ; d', detail of ligule-teeth,  $\times 50$ ; e, anther-tube,  $\times 8$ ; f, detail of appendages,  $\times 32$ ; g, ovary with pappus,  $\times 4$ ; h, i, achene (nearly mature) and pappus-bristle,  $\times 8$ .

pauca, bracteaformia; caulis erectus, fuscus ad nodos, dichotomus cum 2–4 ramis, rami stricti, inflorescentia paniculata vel corymbiformia; pedunculi filiformes, tomentulosi; capitula pauca, parva, 9–10-flora;

involucrum nigro-viride, glabratum, squamæ exteriores ovatae, 1–1.5 mm longæ, interiores lanceolatae, 5–6 mm longæ cum crista brevissima; corolla flava, 10 mm longa; antheræ viridulae, circa 4 mm longæ; stylus flavus, rami 1.5 mm longi; achænia fusca, 3.25 mm longa, fusiformia, compressa, forte attenuata ad apicem, cum 14 costis inæqualibus; pappus albus, 3.5–4 mm longus, persistens.

Perennial, 9 to 28 cm high; taproot slender, woody, straight or oblique; caudex 4 to 7 mm wide, covered with brown bases of old petioles; caudical leaves 4 to 7, ascending, up to 10 cm long, 1.5 cm wide, obovate to oblanceolate, obtuse or acute, sinuately or runcinately dentate, papillose-mucronate, margin retrorsely revolute, abruptly or gradually attenuate into a winged petiole, brown-woolly at base of petiole, fuscous-tomentose below, pubescent above with short pale crinkled several-celled trichomes; cauline leaves 1 to 3, reduced, linear, mostly bractlike, brown-woolly at base; stem erect, sinuate, terete, striate,  $\pm$  brown-woolly especially at bifurcations, dichotomously 2- to 4-branched, branches strict, slender, shorter than or equal to axis, aggregate inflorescence paniculate-corymbiform; peduncles 4 to 15 mm long, filiform, lanate or tomentulose; heads few, erect, small, 9- to 10-flowered; involucre cylindric, 6 to 7 mm high, dark green, glabrous; outer involucral bracts about 5, ovate, 1 to 1.5 mm long, acute or acuminate; inner bracts 8, lanceolate, acute, 5 to 6 mm long, with pale membranous margins, glabrous on both sides, dorsally 1-nerved, alternate bracts with a very short wing or small salient claw near tip; corolla 10 mm long; ligule 1.5 mm wide; teeth 0.6 mm long, conspicuously gland-crested, hooded, anteriorly labiate; corolla-tube 2 mm long, sparsely pubescent with very short (up to 0.1 mm) acicular hairs; anther-tube about  $4 \times 1$  mm dis., greenish yellow; filaments slender, extending beyond appendages 0.3 mm; appendages 0.7 mm long, oblong, obtuse, united; style-branches 1.5 mm long, 0.1 mm wide, attenuate toward tip, yellow; achenes (nearly mature) dark brown, 3.25 mm long, 0.5 mm wide, fusiform, strongly attenuate to the narrow (about 0.2 mm wide) summit below the slightly expanded pappus-disk, narrowed to the oblique calloused hollow base, base 0.25 mm wide,  $\pm$  compressed, about 14-ribbed, ribs unequal, with 3 to 4 stronger ones, rounded, spiculate toward summit; pappus white, 3.5 to 4 mm long, 2-seriate, rather coarse, soft, barbellulate, persistent. Flowering May to June; flowers yellow, ligules tinged purplish red, teeth purple.

Known only from the type locality.

CHINA: Yunnan, rocks on mountain behind Tong-tchouan (= Tung-chwan?), 2600 m alt., *E. E. Maire* (DL), right-hand plant is *type*; *ibid.*, fissures of rocks, mountains behind Tong-tchouan, 2700 m alt., *E. E. Maire* 2872 (UC).

#### RELATIONSHIP

Close to *Y. fusca*, from which it is very distinct in the more strongly attenuate achenes and much shorter pappus, the shorter florets and style-branches, and the shorter, oblong, obtuse anther-appendages.

Similar also to *Y. paleacea typica*, but smaller, and differing from all three subspecies of *paleacea* in the strongly attenuate but scarcely beaked achenes. From its close resemblance to *paleacea* and its small size, it



might well be one of the diploid ancestors of that polyploid species. This supposition is supported by the comparison of stomatal sizes. In *Y. lanata* the average length of the stomata on caudical leaves is  $26\ \mu$ , whereas on *paleacea typica* it is  $34\ \mu$ . Another species which, from its morphology, may have been one of the diploid ancestors of *paleacea* is *Y. Mairei*. From this species *lanata* is distinct in its larger, more attenuate achenes, longer florets, anther-tubes, and style-branches, and shorter, obtuse anther-appendages.

14. *Youngia fusca* (Babcock) comb. nov. (Fig. 20)

Perennial, 20 to 40 cm high; taproot slender, woody, oblique or straight; caudex 1 cm wide, leafy or covered with brown bases of old leaves; caudical leaves up to 8 cm long, 1.5 cm wide, oblanceolate, acute,

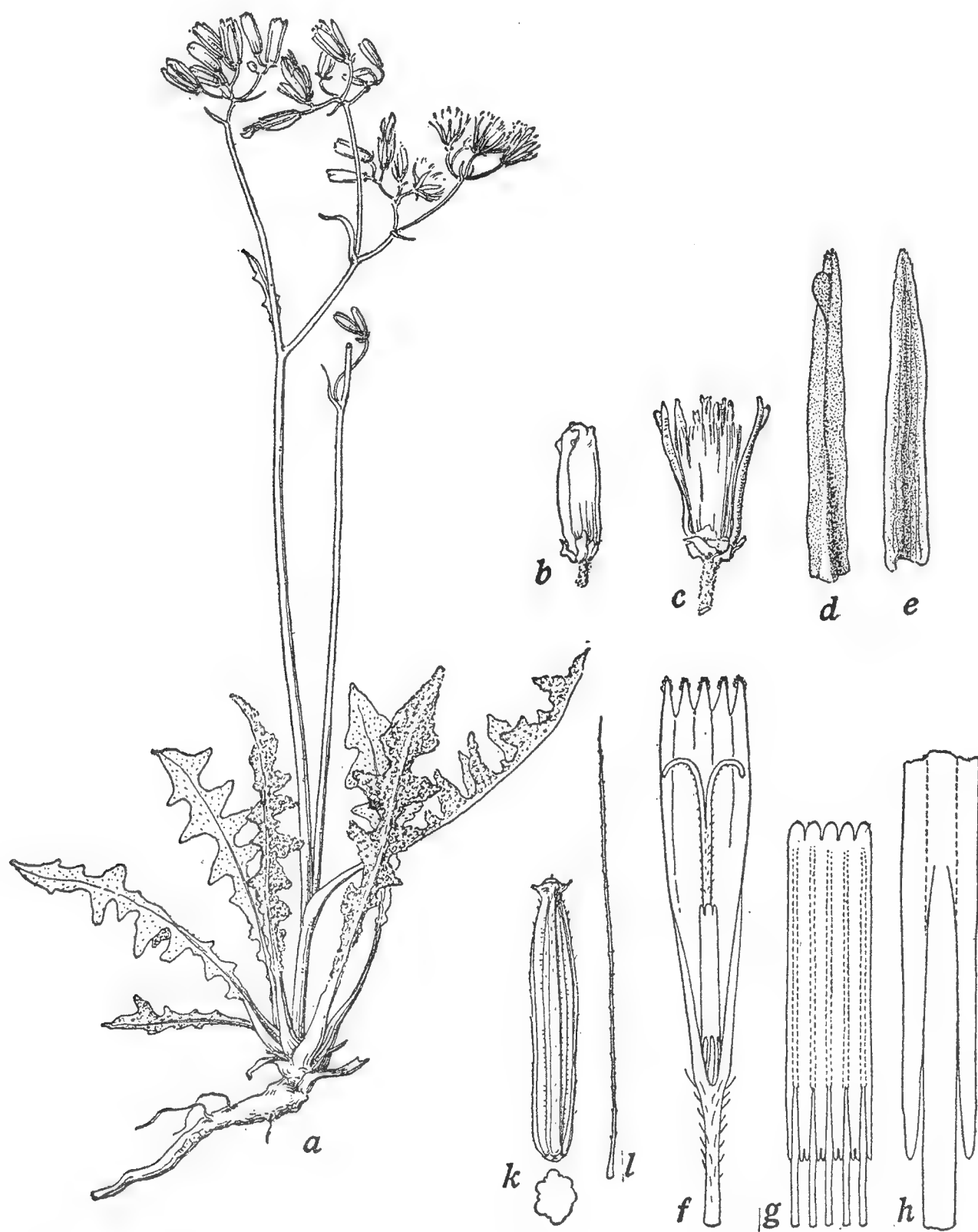


FIG. 20—*Youngia fusca*, from type (K): a, plant,  $\times \frac{1}{2}$ ; b, young head,  $\times 2$ ; c, head before anthesis, part of inner bracts removed,  $\times 2$ ; d, e, 2 inner involucre bracts, dorsal and ventral,  $\times 4$ ; f, floret lacking ovary,  $\times 4$ ; g, anther-tube,  $\times 8$ ; h, detail of appendages,  $\times 32$ ; k, achene and outline of cross-section,  $\times 8$ ; l, pappus-bristle,  $\times 8$ .

attenuate into a winged petiole with clasping base, sinuate-dentate to runcinate-pinnatifid, margins retrorsely revolute, brown-woolly at base of petiole and beneath, densely pubescent above with short crinkled hairs; cauline leaves similar, or sessile, subamplexicaul, uppermost linear

or bractlike; stem erect, sinuate, terete, striate, fuscous-tomentose at bifurcations, remotely 5- to 7-branched beginning near base, each branch bearing a cymose-corymbiform cluster of 2 to 7 heads; peduncles 0.2 to 2.5 cm long, very slender, fuscous-tomentose; heads erect, small, about 10-flowered; involucre cylindric, about 8 mm long, dark green, glabrous; outer involucre bracts 5 to 6, up to 1.5 mm long, ovate, acute; inner involucre bracts 8, about 7 mm long, 1 mm wide, lanceolate, acute, ventrally glabrous or with a few short appressed hairs, dorsally nerved, becoming spongy-thickened near base in fruit, with a rounded wing 0.4 to 0.7 mm long near tip, wing sometimes obscure or absent; corolla about 12 mm long; ligule 2 mm wide; teeth about 0.75 mm long, narrow, gland-crested, hooded; corolla-tube 3 mm long, pubescent with spreading acicular hairs up to 0.15 mm long; anther-tube about  $3.75 \times 1$  mm dis., green; appendages about 0.8 mm long, acuminate, united; style-branches 1.75 mm long, yellow; achenes 3 to 3.5 mm long, 0.5 to 0.6 mm wide, dark reddish brown, columnar, subcompressed, narrowed at the yellow-calloused base, shortly attenuate near the 0.3 mm wide summit, 12-ribbed, ribs unequal, with 3 or 4 more prominent and thickened at base, finely spiculate; pappus white or slightly yellowish, 4 to 5 mm long, 2-seriate, rather stiff, somewhat thickened at base, barbellulate, persistent. Flowering May; flowers yellow. (*Crepis fusca* Babcock, in Univ. Calif. Publ. Bot. 14:327, 1928.)

China in eastern and possibly western Yunnan, montane.

CHINA: Yunnan, Yunnanfu, *Ducoux* 839 (K), *type*; *ibid.*, Yunnansen, *E. E. Maire* 482 (UC); *ibid.*, Tcheou-Kia-tse-tong (= Tschau?), rocks beneath trees, 2550 m alt., *E. E. Maire* (E).

#### RELATIONSHIP

Closest to *Y. lanata*, from which it is distinct in its slightly attenuate achenes and much longer pappus, longer florets and style-branches, and longer, lanceolate-acuminate anther-appendages. The average length of stomata in *lanata* is  $26 \mu$ , and in *fusca*  $33 \mu$ ; the average diameter of pollen-grains is  $29 \mu$  in both species. The larger stomata in *fusca* indicate that it is a tetraploid. It does not seem likely, however, that it was derived from *lanata* because of the marked differences in achenes and anther-appendages. The diploid form of *fusca* may yet be discovered.

#### 15. *Youngia Mairei* (Lévl.) comb. nov. (Fig. 21)

Perennial, 18 to 23 cm high; caudex vertical or oblique, 8 to 16 mm long, 4 mm wide, scaly with bases of old leaves, leafy at crown, strongly fibrous below; caudical leaves ascending, up to 7 cm long, 1.5 cm wide, oblanceolate, acute or acuminate, sinuate-denticulate, denticles mucronate, margin broadly retrorsely revolute, attenuate into a short- or long-winged petiole, darker above, pale beneath, finely pubescent on both sides with yellow or brown many-celled piliform trichomes; cauline leaves few, linear or bractlike; stem erect, slender, glabrous, paniculately few-branched or branched only near summit, lower branches paniculately few-headed, upper branches short, cymose-corymbiform; peduncles 6 to 10 mm long, slender, slightly tomentulose near head, 1-bracteate; heads

erect, small, about 12-flowered; involucre cylindric-campanulate, 6 to 7 mm high, 2 to 3 mm wide at middle, dark green; outer involucre bracts usually 5, about 0.75 mm long, ovate, glabrous; inner bracts about 8, lanceolate, acute,  $\pm$  scarious-margined, ciliate at tip, ventrally pubescent

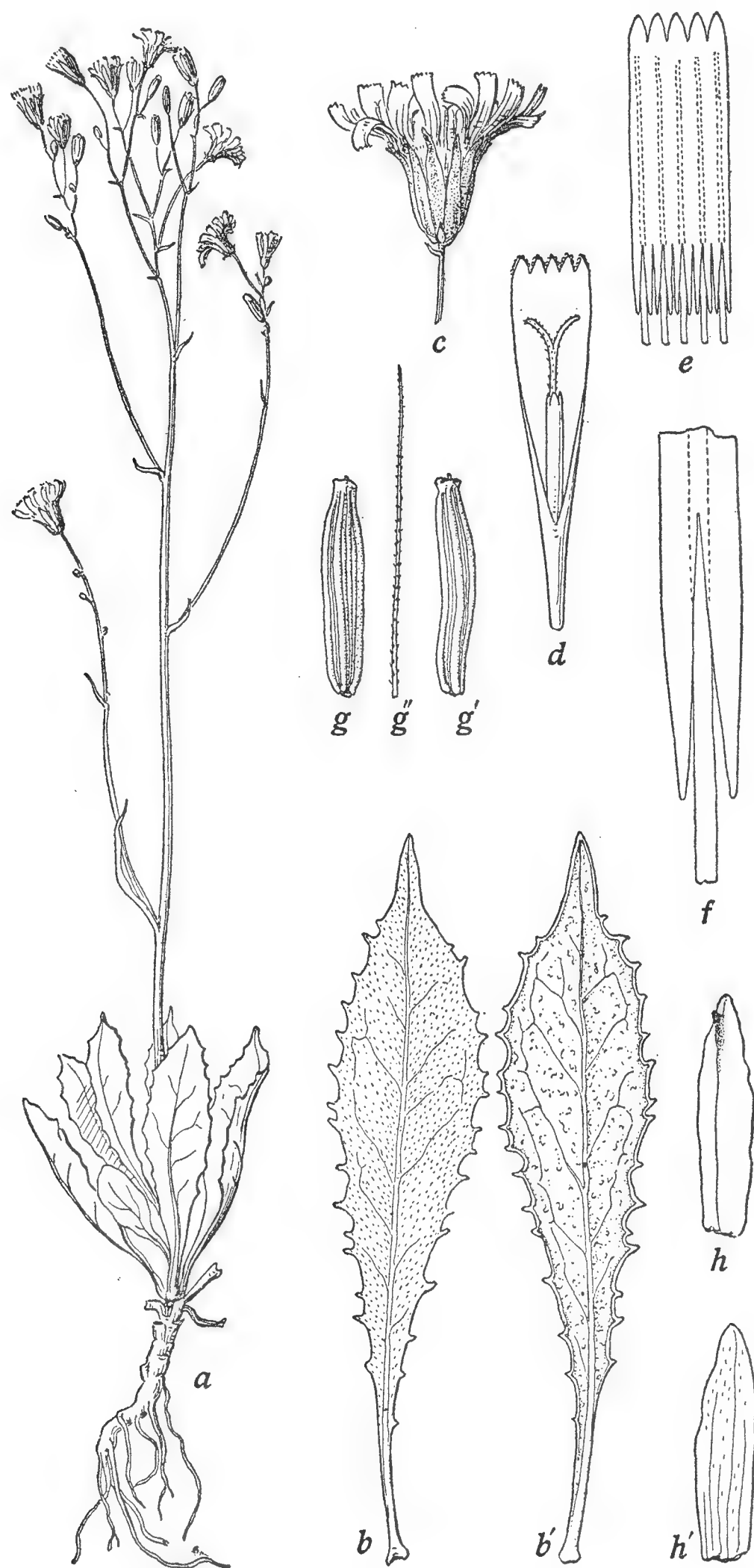


FIG. 21—*Youngia Mairei*, from type (E): *a*, plant,  $\times \frac{1}{2}$ ; *b*, *b'*, small leaf, upper and lower sides,  $\times 2$ ; *c*, head,  $\times 2$ ; *d*, floret lacking ovary,  $\times 4$ ; *e*, anther-tube,  $\times 8$ ; *f*, detail of appendages,  $\times 32$ ; *g*, *g'*, *g''*, two achenes and a pappus-bristle,  $\times 8$ ; *h*, *h'*, inner involucre bract, dorsal and ventral sides,  $\times 4$ .

with very short appressed shining hairs, dorsally glabrous, median-nerved, nerve darker, shortly alate near tip, becoming carinate near base; corolla 8.5 mm long; ligule 1.75 mm wide; teeth 0.4 mm long, glanduliferous dorsally to margin; corolla-tube 2.4 mm long, glabrous;

anther-tube  $3.5 \times 1.1$  mm dis.; filaments short, extending beyond appendages 0.3 mm; appendages 0.8 mm long, lanceolate, acuminate, free; style-branches 0.75 mm long, yellow; achenes brownish purple, 2.5 mm long, 0.4 mm wide, linear, slightly attenuate to the 0.25 mm wide summit, with very slightly expanded pappus-disk, constricted at the equally narrow hollow lightly calloused base, 14- to 15-ribbed, ribs unequal, 4 or 5 stronger, finely spiculate, spicules pale; pappus white, about 3.5 mm long, 1-seriate, united at base, coming away in clumps, fine, soft, barbellulate, persistent. Flowering June; flowers yellow, anthers yellow *in sic.*, style yellow. (*Crepis Mairei* Lévl., in Fedde, Repert. 12: 531, 1913.)

Known only from the type locality.

CHINA: Yunnan, mountains behind Tong-tchouan (= Tungchwan?), among rocks, 2600 m alt., *E. E. Maire* in 1912 (E).

#### RELATIONSHIP

Closest to *Y. fusca*, from which it is very distinct in leaves, habit, flowers, and fruits. It is suggested that *Y. Mairei* may have been one ancestor of *Y. paleacea*.

#### 16. *Youngia Wilsoni* (Babcock) comb. nov. (Fig. 22)

Perennial, 13 to 16 cm high, completely glabrous except corolla-tube; rootstock slender, woody, straight or oblique, strongly branched; caudex short, about 6 mm wide, leafy; caudical leaves 6 to 8, up to 6 cm long, 1.5 cm wide, oblong or broadly oblanceolate, acute or acuminate, runcinate-pinnatifid with acuminate segments 3 to 7 mm broad at base, mucronate, denticulate, attenuate toward base into a very short broad petiole with clasping base, margin retrorsely revolute, glabrous on both sides, midrib white and prominent beneath, brown and inconspicuous above, secondary veins leaving midrib at broad angles; lowest cauline leaves similar, the others linear, bractlike; stems 1 to 3, erect or somewhat curved, corymbosely few-branched, branches 1- to 2-headed, rather slender, terete, striate; peduncles 0.8 to 3.8 cm long, arcuate; heads erect, medium, about 11-flowered; involucre cylindric, 7.5 to 8.5 mm high; outer involucre bracts 7 to 8, very short, broadly ovate, acute; inner involucre bracts 7 to 8, lanceolate, acute, innermost scarious-margined, ventrally glabrous, becoming spongy-thickened dorsally near base in fruit, neither corniculate nor tuberculate; receptacle areolate, naked; corolla 12 mm long; ligule 1 mm wide; teeth 0.5 mm long, crowned with a few large cells; corolla-tube 3.5 mm long, beset with short 2-celled trichomes; anther-tube  $3.5 \times 1.2$  mm dis.; appendages 6 mm long, oblong, obtuse, united; style-branches yellow, 1.2 mm long; achenes very pale brown, 3 to 3.5 mm long, 0.8 mm wide, dorsoventrally compressed, oblong, definitely attenuate at summit with slightly expanded pappus-disk and at the calloused hollow base, about 15-ribbed, ribs unequal, with 3 to 4 stronger ones, finely spiculate; pappus white, 5 mm long, in 1 series of rather coarse soft barbellulate bristles, persistent. Flowers yellow. (*Crepis Wilsoni* Babcock, in Univ. Calif. Publ. Bot. 14:331, 1928.)

Known only from the type locality. Collected by E. H. Wilson in June, 1901.



CHINA: western Hupeh, *Wilson 2168A* (B type, NY, UWG cotypes). On the type sheet in Berlin are two plants of this species which may be designated as no. 2168A, and a third, the left-hand specimen, 2168B,

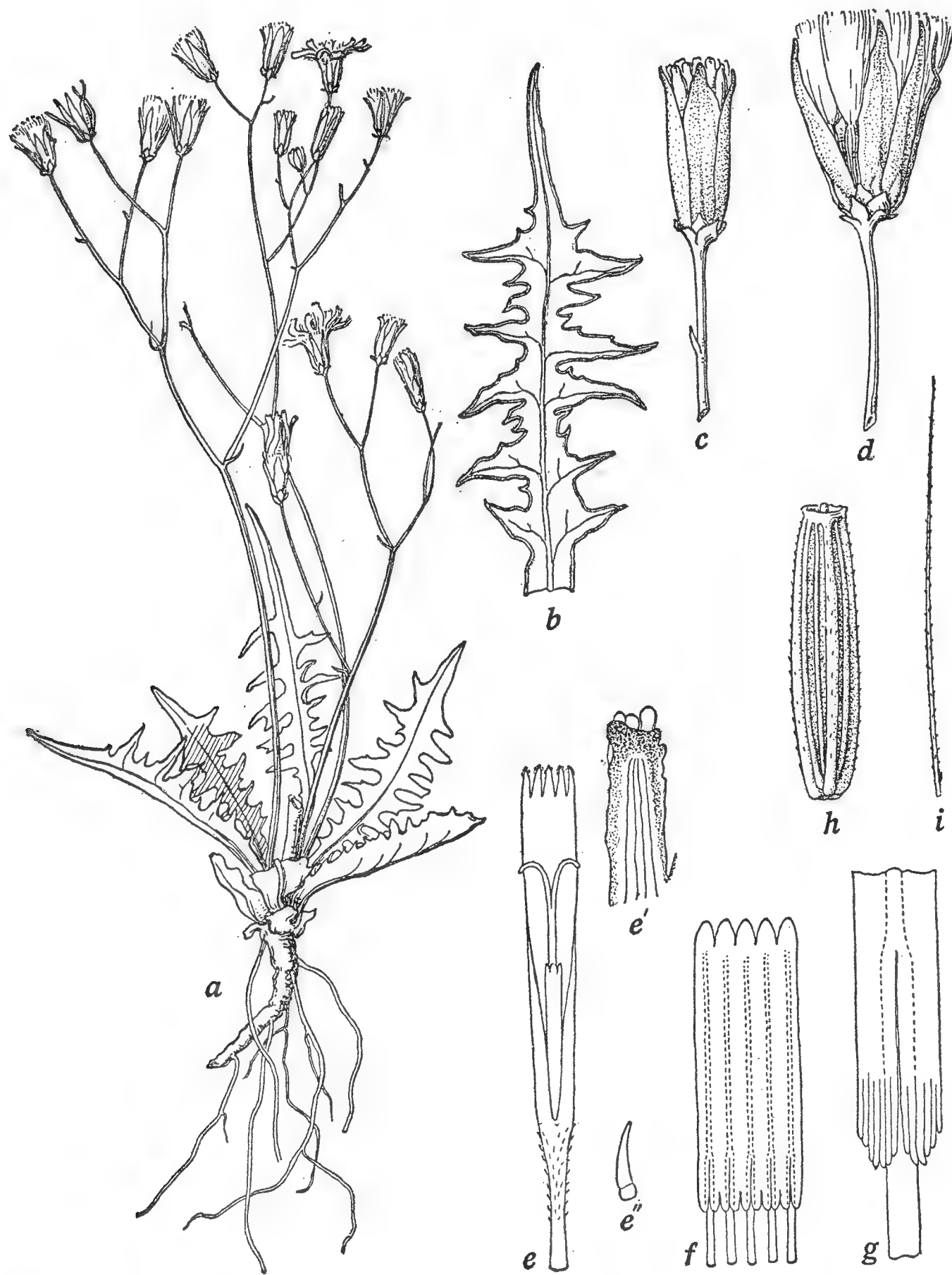


FIG. 22—*Youngia Wilsoni*, from *Wilson 2168A* (NY), cotype: *a*, plant,  $\times \frac{1}{2}$ ; *b*, upper three-fourths of a radical leaf, lower face,  $\times 1$ ; *c*, young head,  $\times 2$ ; *d*, mature head,  $\times 2$ ; *e*, floret lacking ovary,  $\times 4$ ; *e'*, detail of ligule-tooth,  $\times 25$ ; *e''*, hair from corolla-tube,  $\times 50$ ; *f*, anther-tube,  $\times 8$ ; *g*, detail of appendages,  $\times 32$ ; *h*, *i*, achene and a pappus-bristle,  $\times 8$ .

which is *Y. Pratti*. On the duplicate sheet in New York are one plant of 2168A and parts of a specimen of 2168B. On the duplicate sheet in Vienna is a cotype of *Wilsoni*, 2168A; a specimen of *Pratti*, 2168B; and a third specimen, 2168C, which is a form of *Wilsoni* smaller than the type, with smaller leaves but otherwise similar except that the achenes are less strongly ribbed and the pappus is a little shorter and finer.

#### RELATIONSHIP

That this species is more closely related to *Y. Pratti* and *Y. Henryi* and less closely to *Y. paleacea* and its allies, is indicated by its complete glabrousness and absence of crests on the involucre. In leaf form it is inter-

mediate between *paleacea* and *Pratti*, but the linear-caudate terminal lobe and acuminate lateral lobes of the leaves indicate closer affinity with the latter. From *Pratti* it is very distinct in the low corymbose habit, leaf venation, involucre bracts glabrous within, broader anther-tube with shorter and broader appendages, and the larger, less attenuate achenes and white pappus. From *Y. Henryi* it differs strikingly in leaves, flowers, and achenes.

17. **Youngia Pratti** (Babcock) comb. nov. (Pl. 2; fig. 23)

Perennial, about 60 cm high, glabrous throughout except corolla-tube and inner face of involucre bracts; caudex woody, cylindrical, elongate, up to 5 mm wide, remotely scaly with bases of old leaves, prolonged into a slender straight oblique or horizontal rootstock bearing strong fibrous roots; caudical leaves up to 10 cm long, 2 cm wide, oblanceolate, runcinate-pinnatifid or pinnately parted, terminal segment lanceolate, acute or acuminate, lateral segments remote, broadly triangular, acute, mucronate, gradually reduced into the narrowly winged petiole with broader clasping base, pale beneath, dark above, margin retrorsely revolute, veins leaving midrib at narrow angles; cauline leaves similar but all segments linear, acute or acuminate, lateral segments  $\pm$  salient, sometimes obscurely 1-dentate on lower margin, uppermost leaves entire, linear or filamentous, bractlike; stem erect or sinuate, terete, striate, paniculately remotely branched above middle or from base, the lowest branches 9 to 30 cm long, slender, rather strict or arcuate, dichotomously branched and rebranched, secondary branches 1- to 6-headed, the aggregate inflorescence a compound corymbose panicle; peduncles 0.5 to 2.5 cm long, very slender, not thickened near head; heads erect, small, about 10-flowered; involucre cylindric, 7 to 8.5 mm long, 2 mm wide; outer involucre bracts 5 to 7, very short, obtuse or acute; inner involucre bracts 7 or 8, lanceolate, acute or obtuse, dark green, scarious-margined, neither corniculate nor tuberculate, ventrally pubescent with short shining appressed hairs, becoming carinately spongy-thickened dorsally near base and partly reflexed at maturity; receptacle areolate or subfimbriate, fimbriæ low, naked; corolla 10 to 12 mm long; ligule 1.4 to 2.5 mm wide; teeth 0.3 to 0.7 mm long, serrately glanduliferous, not hooded; corolla-tube 2.5 to 3 mm long, pubescent with short (0.05 to 0.3 mm) 2-celled acicular hairs; anther-tube dark green,  $3.5 \times 1.0$  mm dis.; filaments extending beyond appendages 0.75 mm; appendages 0.7 to 1.0 mm long, oblong, obliquely acute, united; style-branches yellowish or reddish brown before extrusion *in sic.*, 1.5 to 1.7 mm long, 0.1 mm wide, obtuse at tip; achenes (nearly mature) 2.5 mm long, 0.4 mm wide, tawny or pale brown, fusiform, dorsoventrally compressed or subcompressed, rather abruptly attenuate at summit, with slightly expanded pappus-disk, less attenuate toward the hollow prominently calloused base, 12- to 13-ribbed, ribs unequal, with 5 broader ones, rounded, smooth or minutely rugulose; pappus cream white, 4 to 5 mm long, in 1 series of rather coarse stiff barbellulate bristles, persistent. Flowering ?midsummer; flowers yellow. (*Crepis Pratti* Babcock, in Univ. Calif. Publ. Bot. 14:331, 1928.)

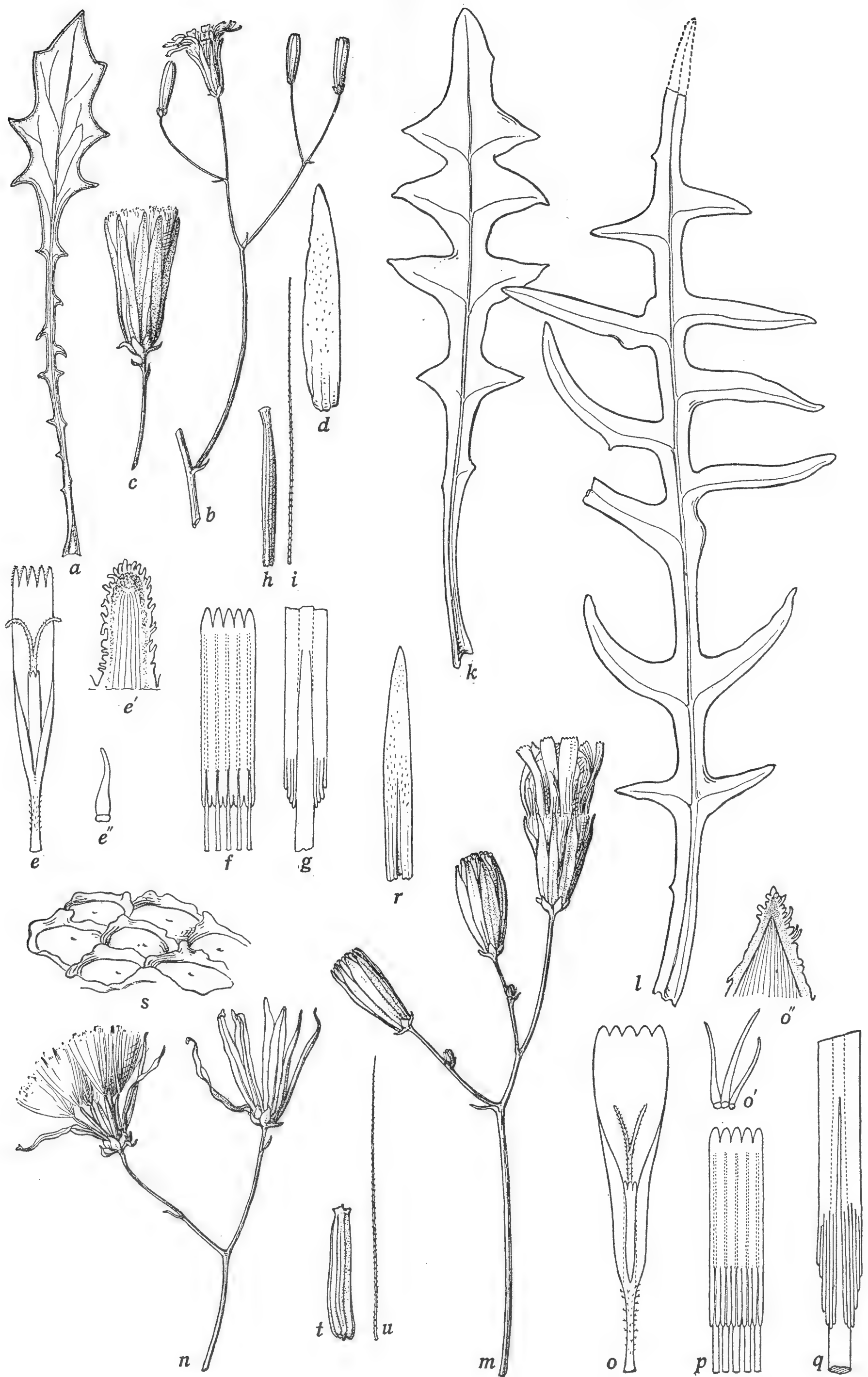


FIG. 23—*Youngia Prattii*, *a-i*, from type (K); *k-u*, from *Pratt 114* (K): *a*, early caudical leaf, lower surface,  $\times 1$ ; *b*, branch,  $\times 1$ ; *c*, nearly mature head,  $\times 2$ ; *d*, inner involucral bract, inner face,  $\times 4$ ; *e*, floret lacking ovary,  $\times 4$ ; *e'*, detail of ligule-tooth,  $\times 25$ ; *e''*, hair from corolla-tube,  $\times 50$ ; *f*, anther-tube,  $\times 8$ ; *g*, detail of appendages,  $\times 32$ ; *h*, *i*, achene (immature) and a pappus-bristle,  $\times 8$ ; *k*, *l*, later leaves, upper surface,  $\times 1$ ; *m*, *n*, heads,  $\times 2$ ; *o*, floret lacking ovary,  $\times 4$ ; *o'*, hairs from corolla-tube,  $\times 50$ ; *o''*, detail of ligule-tooth,  $\times 25$ ; *p*, anther-tube,  $\times 8$ ; *q*, detail of appendages,  $\times 32$ ; *r*, inner bract, inner face,  $\times 4$ ; *s*, detail of receptacle,  $\times 25$ ; *t*, *u*, achene and pappus-bristle,  $\times 8$ .



48  
= 104  
Pratti



*Youngia Pratti*, type (K)





Central and western China. The type region is described as "W. Szechwan and Tibetan frontier, chiefly near Tatsienlu, 2727–4090 m."

CHINA: western Szechwan, *Pratt 63 = 114* (K), *type*; *ibid.*, *Pratt 114* (K), cotype; western Hupeh, *Wilson 2168B* (B, NY, UWG), form 1; Hupeh, Hsingshan, 2424 m alt., *Henry 6069A* (K, G), form 2.

Polymorphism in this species is probably due to chromosomal variations, although hybridization may be involved. In the cotype, which closely resembles the type, the pollen is irregular, although mostly 3-pored. The same is true of another collection (cf. form 1). This may indicate that these forms are either autotriploids or interspecific hybrids. In either case they may be reproducing apomictically. A third form (cf. form 2) is a smaller plant with smaller heads and this may be the diploid progenitor (or one progenitor) of the type form and form 1.

#### NUMBERED FORMS

1. *YOUNGIA PRATTI*, but cauline leaves less deeply pinnatifid; involucre 10 mm long; corolla about 14 mm long; anther-tube 5 mm long; style-branches 1 mm long. This may be a distinct species, but the herbarium material is fragmentary and there are no fruits. *Wilson 2168B* (B, NY, UWG), western Hupeh.
2. *YOUNGIA PRATTI*, but smaller throughout; plant 24 to 28 cm high; caudical leaves up to 7 cm long, 1 cm wide; cauline leaves few, pinnately parted, lateral segments narrowly triangular to linear, terminal segment acuminate to linear-caudate; stem slender, remotely few-branched from middle, few-headed; heads small, about 10-flowered; involucre 6.5 to 7.5 mm long; florets lacking; achenes (nearly mature) about 2 mm long, 0.3 mm wide, brown, subterete, unequally ribbed, constricted at summit with expanded pappus-disk, prominently calloused at base; pappus cream white, 4 to 5 mm long, 1-seriate. *Henry 6069A* (K, G), 2424 m alt., Hsingshan, Hupeh.

#### RELATIONSHIP

Nearest to *Y. Wilsoni* but very distinct in the tall paniculate habit, venation of leaves, involucre bracts pubescent within, the anther-tube narrower and appendages longer, the smaller, more attenuate achenes, and cream-colored pappus. From *Y. Henryi* it differs in the usually tall robust habit, the extremely different juvenile leaves, the less salient and scarcely dentate leaf-segments, shorter outer involucre bracts, corolla larger, anther-tube shorter and narrower, appendages much longer, achenes less attenuate upward and not spiculate, and the coarser, creamy pappus.

#### 18. *Youngia Henryi* (Diels) comb. nov. (Pls. 3, 4; fig. 24, *a-i*)

Perennial, 15 to 35 cm high, completely glabrous except corolla-tube and inner face of involucre bracts; caudex rhizome, horizontal with strong fibers or vertical, sometimes stoloniferous, prolonged into a woody root, brown-scaly with bases of old leaves, up to 5 mm wide; caudical leaves bifurc, sometimes brown-woolly at base of petiole; early caudical leaves up to 5 cm long, 2 cm wide, broadly ovate and entire or with 1 to 6 lateral lobes, terminal segment broad, acute, coarsely runcinate-dentate, teeth few, broad, triangular, lateral segments narrow, acute, petiole slender, obscurely winged, base clasping; later caudical leaves lanceolate, acuminate, pinnately parted to the narrow obscurely winged rachis, ter-

minal lobe narrow, lateral lobes 8 to 12, lanceolate, acute or acuminate, salient or horizontal, entire or 1-dentate, petiole narrow, equal to or shorter than blade; lower cauline leaves similar or sessile; upper cauline leaves linear, acuminate or bractlike; stem erect or sinuate, slender, terete, paniculately branched above, branches 1- to 4-headed; peduncles 1 to 4

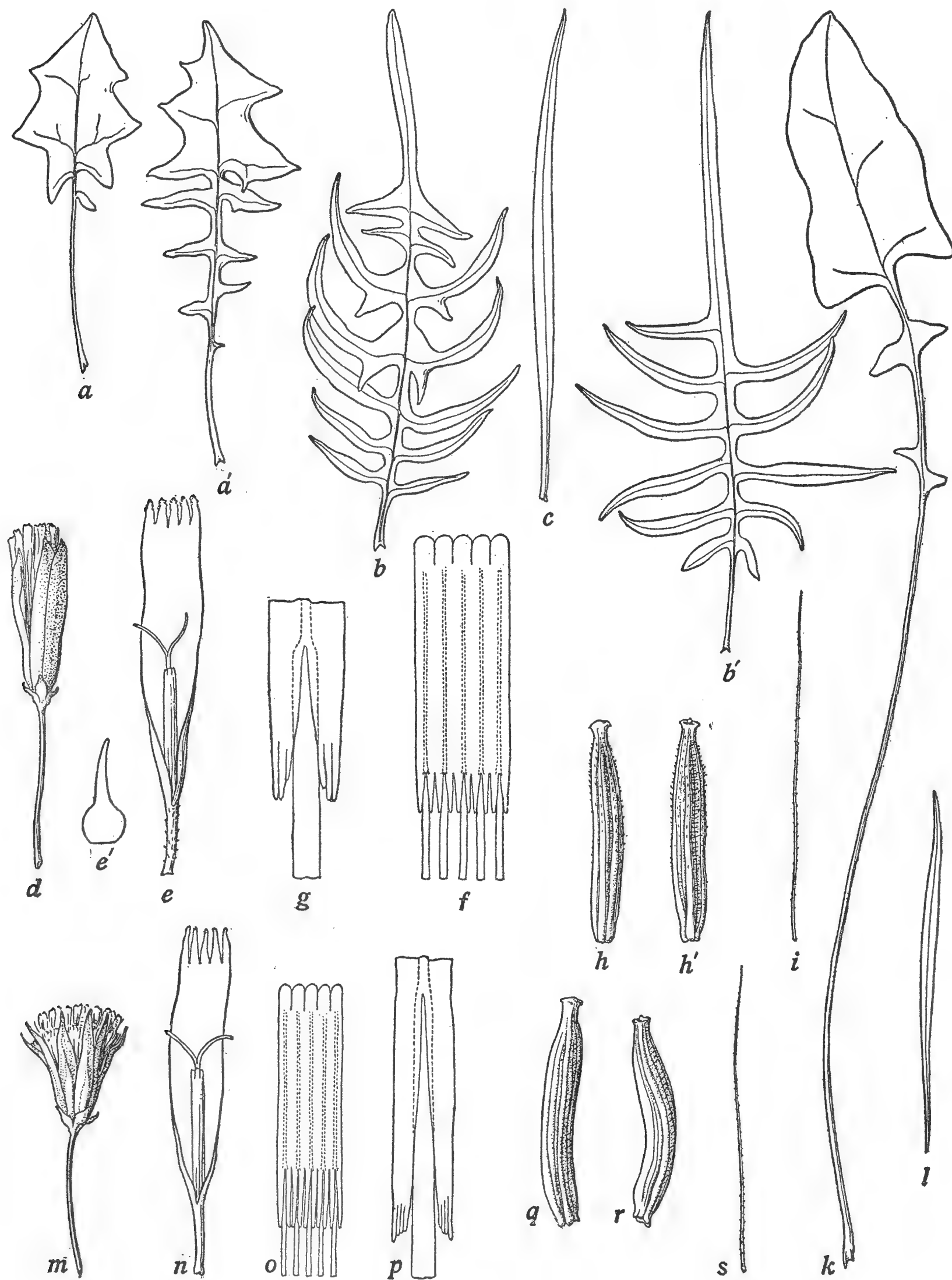


FIG. 24—*a-i*, *Youngia Henryi*, from type and cotypes (B, K): *a*, *a'*, juvenile leaves,  $\times 1$ ; *b*, *b'*, middle cauline leaves,  $\times 1$ ; *c*, upper cauline leaf,  $\times 1$ ; *d*, young head,  $\times 2$ ; *e*, floret lacking ovary,  $\times 4$ ; *e'*, trichome from corolla-tube,  $\times 125$ ; *f*, anther-tube,  $\times 8$ ; *g*, detail of appendages,  $\times 32$ ; *h*, *h'*, *i*, achene, dorsal and ventral, and pappus-bristle,  $\times 8$ .

*k-s*, *Youngia terminalis*, from type (B): *k*, caudical leaf,  $\times 1$ ; *l*, cauline leaf,  $\times 1$ ; *m*, head,  $\times 2$ ; *n*, floret lacking ovary,  $\times 4$ ; *o*, anther-tube,  $\times 8$ ; *p*, detail of appendages,  $\times 32$ ; *q*, *r*, *s*, achenes and pappus-bristle,  $\times 8$ .



DR. AUG. HENRY'S COLLECTIONS FROM  
CENTRAL CHINA, 1885-88.

NO. 6069.  
*Youngia Henryi* Diels

Prov. HUPEH.

Mus. bot. Berol

*Youngia Henryi*, type (B)





*Youngia Henryi*, cotypes (K) below; *Y. terminalis*, type (B) above. Note similarity of the two species particularly in the juvenile leaves.

cm long, very slender, strict or arcuate; heads erect, small, 7- to 10-flowered; involucre cylindric, 7 to 9 mm high, 2 mm wide; outer involucral bracts 5, ovate, obtuse, 1 to 2.5 mm long; inner bracts 7, lanceolate, acute or obtuse, scarious-margined, ventrally sparsely pubescent with short white appressed hairs, dorsally 1-nerved, neither corniculate nor tuberculate, becoming narrowly carinate at base; receptacle areolate, naked; corolla about 11 mm long; ligule about 2 mm wide; teeth 0.5 to 0.7 mm long, gland-crested, hooded with anterior protuberance at tip; corolla-tube about 2 mm long, pubescent with 2-celled acicular hairs up to 0.25 mm long; anther-tube  $4 \times 1.3$  mm dis.; filaments extending beyond appendages about 1 mm; appendages 0.6 mm long, lanceolate, acute, free; style-branches 1.25 mm long, 0.1 mm wide, yellow; achenes light brown, 3 to 3.5 mm long, 0.5 mm wide, oblong, attenuate near the narrow (0.25 mm wide) summit, with slightly expanded pappus-disk, slightly constricted at the 0.3 mm wide finely calloused hollow base, dorsoventrally compressed or subcompressed, about 12-ribbed, ribs unequal with 4 to 5 stronger ones, rounded, spiculate; pappus white, 4.5 to 5 mm long, 1- to 2-seriate, bristles fine, somewhat thickened, united and densely barbel-lulate at base, persistent. Flowering July; flowers yellow, anther-tube green, style-branches yellow. (*Crepis Henryi* Diels, in Engl. Bot. Jahrb. 29:633, 1901.)

China in western Hupeh and western Szechwan, moist places in mountains, roots sometimes embedded in moss.

CHINA: Hupeh, "So. Patung," cliffs, 1818 m alt., *Henry* 6069 (B type, K, G, US 801537 cotypes); *ibid.*, Paokang, *Wilson* 2272 (K, NY); Szechwan, Waschan, south of Yatschou (Yachowtu?), *Weigold* in 1915 (MW).

#### RELATIONSHIP

Closest to *Y. terminalis*, from which it is very distinct in habit, in the pinnatifid cauline leaves, and in various characters of the flowers and fruits, cf. *terminalis*. From *Y. Pratti* it is easily distinguished by the more slender, delicate appearance, the peculiar juvenile leaves with broad terminal segments, the more salient, dentate, lateral leaf segments, the corolla smaller, anther-appendages much shorter, achenes more attenuate upward and strongly spiculate, and the finer, white pappus. Less close to *Y. Wilsoni*, and still less to *Y. tenuifolia*.

#### 19. *Youngia terminalis* sp. nov. (Pl. 4; fig. 24, k-r)

Herba perennis, omnino glabrata; caudex tenuissimus; folia caudicalia longissime petiolata, integra vel lyrata, lobus terminalis amplus, lobi laterales parvi vel absentes; folia caulina pauca, parva, plerumque linearia; caulis tenuissimus, rami pauci, paniculati; pedunculi filamentosi, arcuati; capitula parva, 11-13-flora; involucre angustum; squamæ externæ 5, parvæ, ovatæ; squamæ internæ 8, lanceolatæ; corolla 10 mm longa, flava; antheræ 3.5 mm longæ, virides; achænia fusca, 3 mm longa, forte attenuata, paululum compressa, cum costis inæqualibus; pappus albus, 4 mm longus, persistens.

Perennial, 20 to 50 cm high, glabrous throughout except inner involucral bracts at tip and within; caudex very slender, prolonged into

a fine root, few-leaved; caudical leaves spatulate with very long slender petioles, simple or lyrate-pinnatifid with 1 to 4 lateral lobes, blade or terminal lobe up to 4 cm long, 3 cm wide, orbicular, ovate or oblong, obtuse or acute, truncate or sagittate, entire or sinuate-dentate, lateral lobes absent or small, triangular, obtuse, petiole 2 to 9 cm long, obscurely winged, with broad clasping base; cauline leaves 2 to 4, at the remote bifurcations of stem, mostly linear, filamentous or bractlike; stem erect, very slender, terete, remotely paniculately 2- to 5-branched, branches narrowly arcuate, fine, 1- to 3-headed; peduncles 1.5 to 12 cm long, very fine, arcuate; heads erect, small, 11- to 13-flowered; involucre cylindric, narrow, 7 to 8 mm long; outer involucral bracts 5, ovate, 1.5 mm long; inner bracts 8, lanceolate, acute, scarious-margined, finely appressed-pubescent within, with median dorsal nerve, somewhat thickened or tuberculate near the white-ciliate tip; corolla 10 mm long; ligule 1.5 mm wide; teeth about 1 mm long, gland-crested, hooded; corolla-tube 2 mm long, glabrous; anther-tube  $3.5 \times 1$  mm dis.; filaments extend beyond appendages 0.75 mm; appendages about 0.8 mm long, narrow, sagittate; style-branches 1.25 mm long, 0.1 mm wide, yellow; achenes dark brown, somewhat curved, 3 mm long, 0.5 mm wide, strongly attenuate to the 0.2 mm wide summit, with slightly expanded pappus-disk, narrowed at the small calloused hollow base, subcompressed, about 12-ribbed, ribs unequal with 3 to 4 stronger ones, obscurely spiculate or muriculate; pappus white, about 4 mm long, 1-seriate, bristles fine, slightly thickened and united at base, persistent. Flowering August; flowers yellow, anther-tube green, styles yellow. The long, fine petioles, slender stems, and massed fibrous roots of a clump of young plants suggest that the plants are found in moist, shady places and that they spread by stolons or root-sprouts.

Known only from the region of the type collection, which, according to the label, is Tongol in eastern Tibet. Such a locality is not given in eastern Tibet by the standard atlases. The station is probably Tongolo in western Szechwan, north of Tatsienlu at an elevation between 900 and 1800 m. This supposition is supported by a second collection from Tatsienlu, "eastern Tibet."

CHINA: western Szechwan, Tongolo?, *Soulié* 2652 (B type = 2562A); *ibid.*, Tatsienlu, *Soulié* 2118 (B).

#### RELATIONSHIP

Close to *Y. Henryi*, and the caudical leaves remind one of the juvenile leaves of the latter species. But *terminalis* is very distinct in the cauline leaves and habit, the glabrous corolla-tube, smaller anther-tube, longer anther-appendages, and dark brown achenes with nearly smooth ribs.

### SECTION 6. EUYOUNGIA

#### RELATIONSHIPS OF THE SPECIES

Although extreme reduction in size of heads, flowers, and fruits is characteristic of all the species in this section, there are marked differences between species in other respects. Two of the species, *heterophylla* and *bifurcata*, are either perennial or biennial. The former is the only



species in the section with 2-seriate pappus, and the plant is often tall and robust. Perhaps it may be considered the most primitive member of the section. In *bifurcata* size of the plant is much reduced, but it has the largest achenes of any species in the section. The next two species, *Rosthornii* and *longipes*, are also tall, robust plants and are probably perennials. They are more closely related to *heterophylla* than to *bifurcata*, which has no very close relatives, although it shows most resemblance to *japonica*. The other three species are annuals, but the close relationship of *japonica* to *heterophylla* and *Rosthornii* is shown by the similar flowers and fruits and the marked tendency in *japonica* for the plant to be tall and robust, although extremely aberrant depauperate forms occur and some forms have the smallest achenes of any species in the genus. The last two species, *rubida* and *erythrocarpa*, are marked by reduction in size of the plant and all parts. They are closely related, although very distinct from each other. In leaf shape they show more resemblance to *heterophylla* than to *japonica*, and the unusual color of the achenes is more like that of *longipes*. All the species of this section, with the possible exception of *bifurcata*, must be considered as fairly closely related, but most of them are too little known to justify a hypothesis concerning their phyletic relations.

20. **Youngia heterophylla** (Hemsl.) comb. nov. (Fig. 25, a-q)

Biennial or perennial, 30 to 110 cm high; caudex 1 cm long, 4 to 8 mm wide, bearing fleshy fibers below and/or a fleshy taproot, leafy above; caudical leaves up to 23 cm long, lyrate, terminal segment conspicuous, up to 8 cm long, 5 cm wide, elliptic or ovate, with truncate or attenuate base, remotely sinuate-denticulate or finely serrate, lateral lobes small or gradually reduced, remote, triangular or oblong, acute, sometimes absent, the narrowly winged petiole then appearing extremely long,  $\pm$  pubescent on both sides with very short coarse pale brown-tipped hairs, sometimes tomentulose along midrib beneath, sometimes fuscous-tomentose at base of petiole; cauline leaves numerous, remote, conspicuous nearly to summit of stem, lowest 2 or 3 similar to caudical leaves or segments narrower, acuminate, middle 2 or 3 with 5 or 3 lanceolate acuminate segments, the terminal one larger, upper 2 or 3 entire, lance-linear, acuminate, gradually reduced, uppermost bractlike; stem erect, terete, striate, fistulose, glabrous or glabrescent, terminated by a dense many-headed corymbiform compound cyme, often remotely paniculately branched above middle, each branch terminated by a similar dense cluster of heads, or in very robust specimens branches elongate or equal to axis, inflorescence more open; peduncles 3 to 18 mm long, very fine, glabrous; heads erect, small, 11- to 25-flowered; involucre cylindric in anthesis, campanulate in fruit, 6 to 7.5 mm high, glabrous; outer involucre bracts 5 to 6, nearly equal, about 1 mm long, ovate, acute, rarely unequal with 1 or 2 up to 2 mm long; inner bracts about 8, lanceolate, acute, inner ones scarious-margined,  $\pm$  pubescent within, mediodorsally nerved, becoming carinately spongy-thickened near base in fruit; receptacle areolate, naked; corolla 7.5 to 8.5 mm long; ligule 1.5 to 2 mm wide; teeth about 0.5 mm long, gland-tipped; corolla-tube about 2 mm





FIG. 25—*a-q*, *Youngia heterophylla*, *a-g*, from cotype (US 800568); *h-q*, from Metcalf 851 (UC 288166): *a*, plant,  $\times \frac{1}{2}$ ; *b*, floret lacking ovary,  $\times 4$ ; *c*, anther-tube,  $\times 8$ ; *d*, detail of appendages,  $\times 32$ ; *e*, *f*, *g*, achenes and pappus-bristle,  $\times 8$ ; *h*, *i*, *j*, *k*, flower-heads,  $\times 2$ ; *l*, floret,  $\times 4$ ; *m*, anther-tube,  $\times 8$ ; *n*, detail of appendages,  $\times 32$ ; *o*, *p*, *q*, achenes and pappus-bristle,  $\times 8$ .

*r-w*, *Youngia longipes*, from type (K): *r*, lower cauline leaf,  $\times \frac{1}{2}$  approx.; *s*, *t*, flower-heads,  $\times 2$ ; *u*, *v*, *w*, achenes and pappus-bristle,  $\times 8$ .

long, densely pubescent with several-celled acicular hairs up to 0.15 mm long; anther-tube green,  $3.75 \times 1$  to 1.25 mm dis.; filaments extend beyond appendages about 0.7 mm; appendages 0.5 to 0.7 mm long, lanceolate or oblique, acute; style-branches about 1 mm long, yellow; achenes dark brownish purple, 2.2 to 3 mm long, 0.5 to 0.6 mm wide, subcompressed, more strongly attenuate toward summit, summit a very short neck 0.15 to 0.25 mm wide, pale, with slightly expanded white pappus-disk, constricted near base, base 0.2 to 0.25 mm wide, hollow, lightly calloused, 14- to 15-ribbed, ribs unequal, 3 to 5 stronger, rounded, strongly spiculate near summit; pappus white or pale yellowish, slightly exceeding bracts, 3 to 4 mm long, 2-seriate, straight, soft, persistent. (*Crepis heterophylla* Hemsl., in Jour. Linn. Soc. 23:475, 1888.)

Western China, in western Hupeh, southern Szechwan, southwestern Hunan, and southern Yunnan; also known from one station in Fukien Province, where it may be adventive.

CHINA: Hupeh Province, Ichang and immediate neighborhood, *Henry* (K), *type*; Hupeh Province, *Henry* 3440 (US 800568), ?cotype; *ibid.*, Patung Hsien, *Chow* 171 (UC); southern Szechwan Province, Techang, bank of small stream, *Schneider* 799 (B); *ibid.*, Nanchwanhsien, roadside, 1500 to 1800 m alt., *Fang* 1360 (B); Fukien Province, Inghok gaing, *Metcalf* 851 (UC); southwestern Hunan Province, Yünshan Mountain, near Wukang above Gwanyingo temple, about 1250 m alt., *Handel-Mazzetti* 12078 (B, UC); Yunnan Province, Mengtze, *Henry* 9788 (NY).

#### RELATIONSHIP

Closest to *Y. longipes*, from which it is easily distinguished by the longer, dark-purplish achenes and the straight, 2-seriate pappus; and the cauline leaves differ notably in shape. Close also to *Y. Rosthornii*, which is very distinct in leaf shape and in the somewhat beaked achenes.

The leaf-shape differences between *heterophylla* and its congeners are striking and constant. Even though there is considerable variation in minor details in the caudical leaves within *heterophylla*, yet these leaves are always lyrate with a very large terminal segment, and the middle cauline leaves are 5- or 3-lobed with lanceolate-acuminate segments.

*Y. heterophylla* is also related to *Y. japonica*, as noted by Hemsley (*loc. cit.*), but it is much more distinct from *japonica* than he assumed. Hemsley's opinion that *heterophylla* approaches very closely to the form of *Y. japonica* formerly treated as a distinct species under the name of *Y. runcinata* DC. is not supported by examination of the type of *Y. runcinata* DC. in Herb. DC.

#### 21. *Youngia bifurcata* sp. nov. (Fig. 26)

Herba perennis, humilis, foliata, cum capitulis parvis; folia caudicalia lyrate, pinnatifida, lobus terminalis ovatus, obtusus, lobi laterales congesti, semi-orbiculares vel triangulares, petiolus brevis dense pubescens; folia caulina pauca, plerumque parva, bracteae similes; caules cum floribus recti, graciles, bifurcati, rami cum 1-2 capitulis; caulis horizontalis vel stolo foliosus, folia caudicalia similia; capitula parva, circa 12-flora; involucrium cylindricum, glabrum; corolla circa 12 mm longa,



FIG. 26—*Youngia bifurcata*, from type (UC 386713): *a*, plant,  $\times 1$ ; *b*, flowering head,  $\times 4$ ; *c*, *c'*, inner involucre bract,  $\times 4$ ; *d*, floret lacking ovary,  $\times 4$ ; *e*, anther-tube,  $\times 8$ ; *f*, detail of appendages,  $\times 32$ ; *g*, *h*, achene and pappus-bristle,  $\times 8$ ; *i*, young head,  $\times 4$ .

flava; antheræ 3.5 mm longæ, virides; achænia circa 3.5 mm longa, subrufa-fusca, cum costis inæqualibus; pappus albus, circa 2.5 mm longus.

Perennial, 12 to 13 cm high; caudex very short, about 8 mm wide, bearing strong fleshy fibers, numerous leaves, several flowering stems, and one horizontal leafy stoloniform stem; caudical leaves up to 10 cm long, 2 cm wide, oblanceolate, obtuse, lyrate-pinnatifid, terminal segment ovate or elliptic, lateral segments close, semiorbicular or triangular, retrorse, gradually diminishing, all segments obscurely papilliform-denticulate, denticles becoming corneous, petiole short, narrowly winged, midrib prominent, pale, like stems pubescent on both sides with brownish many-celled piliform trichomes longer and denser on midribs and base of petioles and stems; leaves of flowering stems mostly reduced, bractiform, the first one sometimes like caudical leaves but smaller; leaves of stoloniform stem like caudical leaves; stems several, slender, erect or arcuate, remotely 2-furcate, densely pubescent at bifurcations, branches 1- to 2-headed; peduncles 1.5 to 4.5 cm long, very slender, 1-bracteate, finely pubescent; heads erect, small, about 12-flowered; involucre cylindric, 6 to 7 mm high, glabrous; outer involucre bracts about 7, pale yellowish, somewhat carinose, 1 to 2 mm long, ovate, acute or obtuse; inner bracts 8, green, lanceolate, acute, white-ciliate at the brown dorsally swollen tip, ventrally pubescent with appressed, shining hairs, mediodorsally nerved, becoming carinate near base in fruit; corolla about 12 mm long; ligule about 2.5 mm wide; teeth 0.2 to 0.5 mm long, brownish at tip *in sic.*, conspicuously gland-crested; corolla-tube about 3 mm long, densely pubescent with stout acicular hairs up to 0.2 mm long; anther-tube  $3.5 \times 1.25$  mm dis., green; filaments extend beyond appendages about 0.4 mm; appendages 0.6 mm long, oblong, obtuse, united; style-branches 2.25 mm long, 0.1 mm wide, attenuate at tip, yellow; achenes, not fully mature, dark reddish brown, 3 to 3.5 mm long, about 1 mm wide, compressed, fusiform, shortly attenuate to the narrow (0.15 mm wide) summit, with expanded white pappus-disk, less attenuate to the constricted narrow hollow lightly calloused base, 12- to 14-ribbed, ribs rounded, strongly spiculate at summit; pappus white, 1-seriate, the bristles very unequal, 1.5 to 2.5 mm long, soft, barbellulate, fine, broader and united at base, coming away in clumps, persistent. Flowering April; flowers yellow, anthers green, styles yellow.

Known only from the type locality.

CHINA: Yunnan, Tong-tchouan (=Tungchwan?), 2500 m alt., cultivated land, *E. E. Maire 2574* (UC 386713) *type*.

#### RELATIONSHIP

Although typically *Youngia*, this distinct species has no very close relatives among the species thus far known. In leaves, involucre, flowers, and fruits, it shows most resemblance to *Y. japonica genuina*; but the heads, florets, and achenes are much larger and the pappus relatively much shorter; moreover the few-headed, furcate flower-stems and the horizontal, leafy, stoloniform stem are unique.



22. *Youngia Rosthornii* (Diels) comb. nov. (Fig. 27)

Perennial(?), over 100 cm high, glabrous; caudex about 8 mm wide, scaly with bases of old leaves, prolonged into a strong root, bearing fibers; caudical leaves lacking; lower cauline leaves up to 20 cm long, 14 cm wide, oblong, bipinnately compound, terminal segments of leaf and lateral divisions about 5 cm long,  $\pm$  hastate-triangular, acuminate, irregularly lobed, remotely denticulate, lateral segments 6 to 8 mm long, irregularly ovate or elliptic, petiole short; uppermost cauline leaves entire, lanc-linear, acuminate; stem terete, fistulose, cymosely branched near summit, aggregate inflorescence corymbiform; peduncles 3 to 10 cm long, very slender, shortly tomentulose; heads erect, small, about 20-flowered; involucre cylindric in anthesis, 6 mm long, 1 mm wide, campanulate in fruit, glabrous; outer involucre bracts 5, ovate, acute, 1 mm long; inner bracts 7 to 8, lanceolate, acute, scarious-margined, ventrally pubescent with fine appressed shining hairs, mediodorsally obscurely nerved, becoming carinately spongy-thickened near base in fruit; corolla 8 to 9 mm long; ligule 1.25 mm wide; teeth 0.2 to 0.4 mm long, inconspicuously gland-tipped; corolla-tube 2.5 mm long, densely pubescent with acicular hairs 0.05 to 0.3 mm long; anther-tube  $2.75 \times 0.75$  mm dis.; filaments extend beyond appendages 0.75 mm; appendages about 0.75 mm long, lanceolate, acuminate, united; style-branches 1 mm long, 0.1 mm wide, yellow; achenes dark brownish purple, 2 to 2.25 mm long, 0.5 to 0.6 mm wide, subcompressed, slightly attenuate toward both ends, strongly constricted at the narrow (0.15 to 0.25 mm wide) summit, slightly constricted at the hollow lightly calloused base, 14- to 15-ribbed, ribs unequal, 3 to 5 stronger, rounded, finely spiculate near summit; pappus white, 3.5 mm long, 1-seriate, straight, fine, united at base, barbellulate, persistent. Flowers yellow, anther-tube green, style yellow. (*Crepis Rosthornii* Diels, in Engl. Bot. Jahrb. 29:632, 1901.)

Western China in southwestern Szechwan and western Hupeh.

CHINA: southwestern Szechwan, Nanchwan, *Rosthorn* 1606, 1607, 1608, 1608a (B), *type* and cotypes; western Hupeh, Nanto, *Wilson* 216 (K, UWG).

## RELATIONSHIP

Close to *Y. heterophylla* and *Y. longipes*, but very distinct from them in the broad, bipinnately compound cauline leaves. The uniseriate pappus is like that of *Y. longipes* except that it is straight instead of spreading; but the achenes are more like those of *heterophylla* except for the strongly constricted or obscurely beaked summit. Less close to *Y. japonica*.

23. *Youngia longipes* (Hemsl.) comb. nov. (Fig. 25, *r-w*)

Perennial (?), 60 to 90 cm high, glabrous or glabrescent; caudical leaves long-petiolate, blade up to 15 cm long, cordate-hastate or sometimes ovate, obscurely lobate, remotely denticulate, acuminate, obtuse or rotundate and apiculate, petiole 10 to 15 cm long, narrow, gradually shorter on upper leaves; stem erect, terete, striate, fistulose(?), simple below the composite corymbiform inflorescence; peduncles very fine, glabrous;



FIG. 27—*Youngia Rosthornii*, from Rosthorn 1608a, 1607, cotypes (B): *a*, lower part of plant,  $\times \frac{1}{2}$ ; *b*, upper part of plant,  $\times \frac{1}{2}$ ; *c*, young head,  $\times 2$ ; *d*, mature head,  $\times 2$ ; *e*, *e'*, inner involucre bract, outer and inner face,  $\times 4$ ; *f*, floret lacking ovary,  $\times 4$ ; *g*, anther-tube,  $\times 8$ ; *h*, detail of appendages,  $\times 32$ ; *k*, *k'*, *l*, achene, ventral and lateral views, and a pappus-bristle,  $\times 8$ .

heads erect, small, 15- to 20-flowered; involucre cylindric in anthesis, campanulate in fruit, 5 to 6 mm high, glabrous; outer involucral bracts 4 to 5, about 0.5 mm long, triangular, acute; inner bracts 8, lanceolate, acute,  $\pm$  scarious-margined,  $\pm$  appressed-pubescent within, mediodorsally nerved; florets not seen; achenes light red, finely mottled with yellow, 4-angled, 1.75 to 2 mm long, 0.4 to 0.5 mm wide, about 0.25 mm wide at summit and base, more strongly attenuate upward, with slightly expanded white pappus-disk, less attenuate to the hollow lightly calloused base, 12- to 14-ribbed, ribs unequal, with 4 stronger, rounded, very shortly and finely spiculate; pappus white, slightly exceeding involucre, 3.5 to 4 mm long, 1-seriate, spreading, fine, soft, persistent. (*Crepis longipes* Hemsl., in Jour. Linn. Soc. 23:476, 1888.)

Known only from the type locality.

CHINA: southern Hupeh, Ichang and immediate neighborhood, A. Henry (K) type.

#### RELATIONSHIP

Closest to *Y. heterophylla* (q.v.), from which it is distinct in the shorter achenes, which are peculiar in color, being reddish purple finely mottled with yellow, and in the uniseriate, fine, spreading pappus-bristles.

#### 24. *Youngia japonica* (L.) DC., Prod. 7:194, 1838. (Figs. 28, 29)

Annual, 8 to 90 cm high, polymorphic; caudex narrow, leafy; caudical leaves oblanceolate, obtuse or acute, lyrate-pinnatifid, terminal segment larger than lateral ones, elliptical, ovate, obovate, or oblong-truncate, lateral lobes many or few, gradually reduced or lacking, petiole short or long, narrowly or obscurely winged, broader at base, glabrous, puberulent or densely pubescent with short or long piliform trichomes often crinkled and brownish *in sic.*, as in *Y. paleacea*; stems 1 to 6, erect, slender or robust, terete, fistulose, glabrous, puberulent or tomentulose near base, paniculately branched above middle or from near base, branches remote, many-headed, cymose-corymbiform; peduncles 2 to 10, 15 mm long, filiform; heads erect, very small, 10- to 20-flowered; involucre cylindric before anthesis, campanulate in fruit, glabrous; outer involucral bracts about 5, very small, triangular or ovate, acute, rather pale; inner bracts about 8, lanceolate, acute or obtuse,  $\pm$  scarious-margined, ventrally pubescent with appressed shining hairs, dorsally becoming carinately and confluent spongy-thickened at base, ultimately reflexed; receptacle areolate, naked; corolla yellow, with or without purple in ligule; anther-tube dark green; style and style-branches yellow; achenes light brown to dark reddish brown, 1.5 to 2.5 mm long,  $\pm$  compressed, fusiform, more strongly attenuate to the narrow summit, with slightly expanded pappus-disk, narrowed at the lightly calloused hollow base, 11- to 13-ribbed, ribs rounded, unequal, 2 to 4 stronger, spiculate; pappus white, 2.5 to 3.5 mm long, 1-seriate, united at base, very fine, soft, persistent, slightly exceeding involucre. Flowering at various times in relation to latitude, altitude, and local climatic conditions.

Japan and Korea to western China and Indo-China; Malay Peninsula to northwestern India; Philippines and Malay Archipelago. Introduced widely throughout the tropics.

The great variability of this species has been noted by various authors. In height and habit of the plant, size and shape of the leaves, amount of indumentum, and arrangement of the heads there are so many minor variations that no attempt has been made to enumerate the different forms. There are, however, two locally distributed entities which occur within the distributional area of the species and which are so distinct from all other variant forms and from the type of the species that they are recognized here as subspecies.

### SUBSPECIES

#### KEY TO THE SUBSPECIES OF YOUNGIA JAPONICA

- Cauline leaves abruptly reduced, all but 1 or 2, or rarely 3 to 5 on one stem,  
very small, linear or merely bracts; anther-tube 1.75 to 4 mm long.  
Involucre 4 to 5 mm long; corolla 4.5 to 6 mm long..... *a. genuina*  
Involucre 6 to 7 mm long; corolla 8 to 10 mm long..... *b. longiflora*  
Cauline leaves very gradually reduced, all but a few bracts in inflorescence  
conspicuous, pinnatifid, petiolate; anther-tube 0.75 to 1 mm long.... *c. Elstonii*

**24a. *Youngia japonica genuina* (Hochr.) comb. nov.**—Plant 8 to 75 cm high; lower cauline leaves similar to caudical leaves, sometimes sessile, sometimes reduced to bracts like all the others; heads 10- to 20-flowered; involucre 4 to 5 mm long; corolla 4.5 to 6 mm long; ligule about 1 mm wide; teeth 0.25 mm long, slightly crested, hooded, with small apical anterior protuberance; corolla-tube about 2 mm long, pubescent on upper half with crinkled hyaline hairs up to 0.1 mm long; anther-tube  $1.75 \times 0.8$  mm dis.; filaments extend beyond appendages about 0.75 mm; appendages about 0.4 mm long, narrow, acuminate, united; style-branches about 0.6 mm long, very narrow; achenes 1.5 to 2 mm long, 0.4 to 0.6 mm wide; pappus 2.5 to 3.5 mm long. Chromosomes,  $2n = 16$ . (*Prenanthes japonica* L., Mant. 107, 1767; *P. multiflora* Thunb., Fl. Jap. 303, 1784; *Chondrilla japonica* Lam., Dict. Encycl. 2:79, 1790; *Chondrilla lyrata* Poir., in Lam., Encycl. Suppl. 2:332, 1811; *Prenanthes striata* Blume, Bijdr. Fl. Ned. Ind. 885, 1825–1826; *Prenanthes fastigiata* Blume, ibid., 886; *Youngia lyrata* Cass., in Ann. Sc. Nat. ser. 1, 23:88, 1831; *Youngia integrifolia* Cass., ibid., 89; *Lactuca napifolia* DC., ex Wight, Contrib. Bot. Ind. 27, 1834; *Youngia mauritiana* et var. *integrifolia* (Cass.), *Thunbergiana*, *runcinata*, *napifolia*, *Poosia*, *ambigua*, *fastigiata*, and *striata* DC., Prod. 7:192, 1838, spec. in Herb. DC. seen by senior author; *Youngia Paosa* Steud., Nom. ed. II, 2:794 sphalm. = *Youngia Poosia* DC., loc. cit.; *Youngia multiflora* DC., op. cit., 194; *Crepis japonica* Benth., Fl. Hongk. 194, 1861; *Crepis lyrata* Benth., ex Clarke, Comp. Ind. 253, 1876, et cf. syn. in ibid.; *Lactuca Taquetii* Lévl. et Vant., in Fedde, Repert. Nov. Spec. Veg. 8:140, 1910; *Lactuca Taraxacum* Lévl. et Vant., ibid., 141, fide Nakai; *Crepis formosana* Hayata, in Jour. Coll. Sci. Tokyo 30(1):163, 1911 ex descr.; *Crepis Taquetii* Lévl., in Fedde, Repert. Nov. Spec. Veg. 11:307, 1912; *Crepis japonica* var. *genuina* Hochr., in Candollea 5:340, 1931–1934.) (Fig. 28, a–j.)



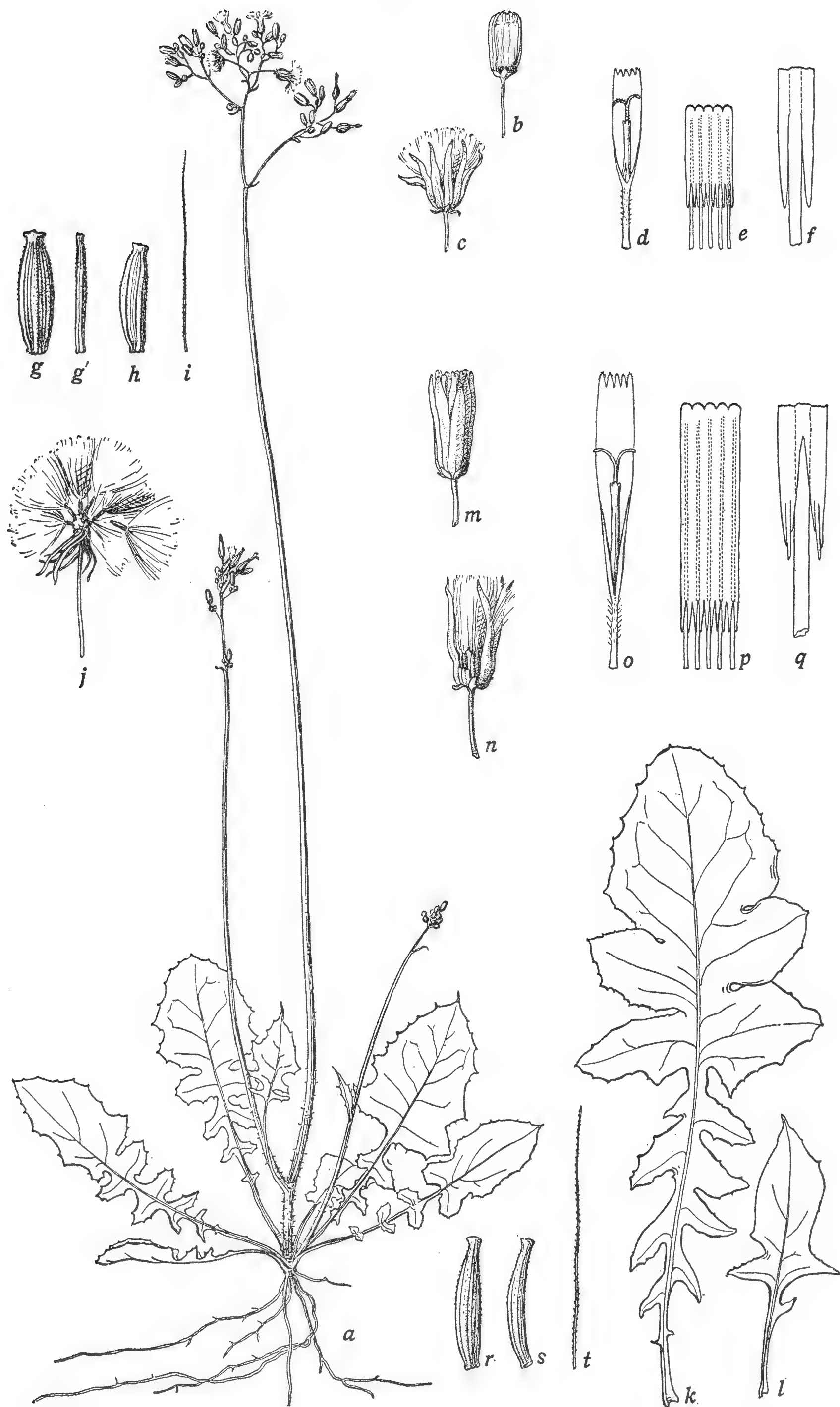


FIG. 28—*Youngia japonica*, a-j, *genuina*, from Tanaka 383 (UC 274336); k-t, *longiflora*, from Tsu 797 (UC 230671): a, plant,  $\times \frac{1}{2}$ ; b, c, young and old heads,  $\times 2$ ; d, floret lacking ovary,  $\times 4$ ; e, anther-tube,  $\times 8$ ; f, detail of appendages,  $\times 32$ ; g, g', marginal achene, front and side views,  $\times 8$ ; h, i, inner achene and a pappus-bristle,  $\times 8$ ; j, mature head,  $\times 2$ ; k, l, radical and cauline leaves,  $\times \frac{1}{2}$ ; m, n, young and old heads,  $\times 2$ ; o, floret lacking ovary,  $\times 4$ ; p, anther-tube,  $\times 8$ ; q, detail of appendages,  $\times 32$ ; r, s, t, marginal and inner achenes and a pappus-bristle,  $\times 8$ .

Distributed throughout the range of the species. Extremely variable in size of plant, shape of leaves, form of aggregate inflorescence, and amount of indumentum on leaves. Among the herbarium material examined, certain forms were found which might easily be confused with other subspecies or species. These will be noted by number below.

JAPAN: Miyazaki, *Tanaka* 383 (UC); Shikoko Island, *Krug* 1308, 1309 (B); Takaoka, mountain near Takao, *Dorsett and Morse* 908 (US); Chikuzen Province, Yamaguchi, *Ikeda* in 1926 (Wellesley). KOREA: Hongno, *Taquet* 1059 (E, as *C. Taquetii* Lévl.). CHINA: Kiangsu Province, Chinkiang, Wuokowsan, *Kolthoff* 160, 214 part (Upsala); *ibid.*, *Kolthoff* 194, 214 part (Upsala), form 3; Szechwan Province, *Morse* 413 part (NY), form 2; Chekiang Province, Mokanshan, *Cheo and Wilson* 12703 (UC); Fukien Province, Foochow, *Chung* 2441 (UC); *ibid.*, Amoy Island, *Chung* 1434 (UC); *ibid.*, pavement, *Chung* 433 (UC), form 1; *ibid.*, Hinghwa, *Lin Pi* 6331 (UC), form 4; Kwangtung Province, Canton, *Shih* 49, 51 (B); *ibid.*, Lung Tau Mountain, near Iu, *C. C. C.* 12007 (UC); Yunnan Province, Mengtze, mountain forests, 1500 m alt., *Henry* 10681 (NY, Mo); *ibid.*, Yunnansen, *Maire* 489 (UC), form 1; central Yunnan, west of Dsolinho River, 2000 m alt., *Handel-Mazzetti* 6222 (UC), form 1. INDO-CHINA: Hue and vicinity, *Squires* 54 (B); Cho Gouh, *Petelot* 1221 (UC). INDIA: western Himalaya, Saharanpur, *Duthie* in 1897 (UC); northwestern Himalaya, Punjab, Murree, *Stewart* 6158 (UC); Madras, Madura, Kodaikanal, *Saulière* 150 (UC); Ceylon, Peradeniya, *Silva* 181 (UC). PHILIPPINE ISLANDS: Luzon, Ilocos Norte Province, Bangui to Claveria, *Ramos* 33055 (UC); *ibid.*, Benquet Province, Mount Pulog, *Ramos* 44898 (UC); *ibid.*, Zambales Province, Mount Pinatubo, *Clemens* 17513 (UC). MALAY ARCHIPELAGO: Celebes, G. Bonthain, about 1500 m alt., *Bunnemeyer* 12130 (UC); New Guinea, Kaiser-Wilhelmsland, 800 m alt., *Schlechter* 18972 (UC). HAWAIIAN ISLANDS: Oahu, Waianae Mountains, Haleauau Valley, *Fosberg* 12978 (UC).

24b. *Youngia japonica longiflora* subsp. nov.—Planta 30–85 cm alta; folia caulina abrupte reducta, plerumque bracteaformia; capitula 18–20-flora; involucre 6–7 mm longum; corolla flava, circa 10 mm longa; antheræ virides, circa 4 mm longæ; stylus flavus, rami circa 1 mm longi; achænia fusco-purpurea, circa 2.5 mm longa; pappus albus, 3.5 mm longus.

Plant 30 to 85 cm high; lower cauline leaves similar to caudical leaves, sometimes sessile, sometimes reduced to bracts like all the others; heads mostly 18- to 20-flowered; involucre 6 to 7 mm long; corolla about 10 mm long; ligule about 1.25 mm wide; teeth 0.4 to 0.5 mm long, slightly crested and hooded with small apical anterior protuberance; corolla-tube 2.5 mm long, densely pubescent on upper half with tortuous 1- to 2-celled, hyaline hairs up to 0.4 mm long; anther-tube about  $4 \times 1$  mm dis.; filaments extend beyond appendages 0.75 mm; appendages 0.5 mm long, lanceolate, acuminate, united; style-branches about 1 mm long, very narrow; achenes dark purplish brown, 2 to 2.6 mm long, 0.6 to 0.7 mm wide; pappus 3.5 mm long. (Fig. 28, *k-t*.)

Southeastern China in Kiangsu, Chekiang, and Hunan Provinces, mostly at low altitudes. Type locality, Nanking.

CHINA: Kiangsu Province, Nanking, *Tsu* 797 (UC 230671), *type*; *ibid.*, Nanking and vicinity, *Nyi* 13 (UC); *ibid.*, Nanking, near university campus, *Chang* 30 (B); *ibid.*, Nanking, *Chun* 952 (B); *ibid.*, Nanking, Purple Mountain, *Chang* 11 (B, UC); *ibid.*, Chingkiang, Wuohowsan, *Kolthoff* 100 (Upsala); *ibid.*, south of Ishing, *Ching and Tsoo* 391 (B); *ibid.*, Poahwashan, *Tsoo* 200 (B); Chekiang Province, Hangchow, *Steward* 2877 (UC); southwestern Hunan Province, Yunshan Mountains, 400 to 1420 m alt., *Handel-Mazzetti* 65 (B, UC).

24c. ***Youngia japonica Elstonii*** (Hochr.) comb.<sup>1</sup> nov.—Plant 55 to 100 cm high or higher; cauline leaves, all but uppermost bracts of inflorescence, large, conspicuous, only gradually reduced from base upward; lower cauline leaves up to 27 cm long, 7 cm wide, oblanceolate, acute, pinnately parted or divided, terminal segment somewhat wider than lateral segments, lateral segments remote, oblong or triangular, acute, irregularly dentate, attenuate into a strong narrowly winged petiole; heads arranged in congested corymbiform clusters at the ends of the paniculate branches, about 20-flowered; involucre 4 to 5.5 mm long; corolla 5 to 6.5 mm long; ligule 0.5 to 0.6 mm wide, often with only 4 teeth; teeth 0.1 to 0.25 mm long, slightly crested, hooded with small apical anterior protuberance; corolla-tube 1.5 mm long, densely pubescent on upper half with 1- to 2-celled tortuous hyaline hairs; anther-tube 0.75 to 1 × 0.5 mm dis.; filaments extend beyond appendages 0.4 to 0.5 mm; appendages 0.3 to 0.4 mm long, very narrow, acuminate, united; style-branches 0.4 mm long, 0.05 mm wide; achenes 1.75 to 2 mm long, 0.3 to 0.4 mm wide; pappus 3 to 3.5 mm long. (*Prenanthes lyrata* Thunb., Fl. Jap. 303, 1784; *Crepis japonica* var. *Elstonii* Hochr., in Candollea 5:340, 1931–1934.) (Fig. 29.)

Southeastern China in Chekiang, Kwangtung, and Kiangsu Provinces, mostly at low altitudes; Hawaiian Islands. Type locality, Hawaii, Kauai, Weimea, Koholuoma.

The type of *Prenanthes lyrata* Thunb. is apparently the same as certain slender forms of this subspecies (cf. UC 346575). Since, however, the combination *Y. lyrata* was used by Cassini for subspecies *genuina*, the authors feel that the application of this epithet to the subspecies here described would be a source of confusion. The type selected is a more extreme form of this subspecies than either of the two specimens of *P. lyrata* in the Thunberg herbarium, which have been examined through the kindness of the curator.

CHINA: Chekiang Province, Soochow University, east of Allen Hall, north side of low wall, *Chang* 540 (UC 346580); *ibid.* (UC 5 sheets); *ibid.*, Mokanshan, Hangchow, *Klautke* 127, 161 (B); *ibid.*, Chekiang, Westlake, *Hu* 1502 (B); Kiangsu Province, Nanking and vicinity, *Nyi* 25 (UC); Kwangtung Province, Canton Delta, *Groff* 2240 (CA). HAWAIIAN ISLANDS: Oahu, Waianae Mountains, Haleauau Valley, *Fosberg* 12981 (UC); Oahu, Kolan Mountains, *Kelly* 168 (CA).

<sup>1</sup> We are indebted to Dr. F. R. Fosberg, of the University of Hawaii, for calling our attention to this subspecific name.



FIG. 29—*Youngia japonica Elstonii*, from type (UC 346580) and cotype (UC 346581):  
*a*, plant,  $\times \frac{1}{2}$ ; *b*, flowering head,  $\times 2$ ; *c*, fruiting head,  $\times 2$ ; *d*, floret lacking ovary,  $\times 4$ ;  
*d'*, part of ligule with only 4 teeth,  $\times 4$ ; *e*, anther-tube,  $\times 8$ ; *f*, detail of appendages,  $\times 32$ ;  
*g*, *h*, *i*, outer and inner achenes and a pappus-bristle,  $\times 8$ .



## NUMBERED FORMS

1. YOUNGIA JAPONICA GENUINA, but very reduced; leaves spatulate, lacking lateral lobes; stem or stems very slender, sometimes semiprocumbent, 1- to 4-headed. These depauperate specimens are obviously the result of very unfavorable environment. They are not to be confused with *Y. terminalis*, as they have heads, flowers, fruits, and indumentum of *japonica*. *Chung 433* (UC 420273), growing in cracks of pavement, Fukien, China; *Handel-Mazzetti 6222* (UC 259887), cold temperate region west of Dsolinho River, central Yunnan, China; *Maire 489* (UC 223238), near Yunnan, Yunnan, China.
2. YOUNGIA JAPONICA GENUINA, but leaves densely pubescent with the same peculiar hairs as those found generally in this subspecies; plants only 8 to 12 cm high; stems slender, few-headed; achenes 1.5 to 2 mm long; pappus 2.5 to 3 mm long. *Morse 413a, 1, 2, 3, 4* (NY), Szechwan. Besides the four plants cited above, on same sheet are fragments of another plant which may be subspecies *longiflora*, although Szechwan is far removed from the type region of this subspecies.
3. YOUNGIA JAPONICA GENUINA, but plant 60 to 75 mm high; stem rather stout, lower branches elongate. Leaves, heads, flowers, and fruits as in *genuina*. On account of the unusually large size of the plants this might be mistaken for subspecies *Elstonii*, but the cauline leaves are abruptly reduced as in *genuina*. *Kolthoff 194, 214* (Upsala), Wuokowsan, Chinkiang, Kiangsu, China.
4. YOUNGIA JAPONICA GENUINA, but caudical leaves unusually broad (up to 9 cm) with congested lateral lobes, finely puberulent under lens but apparently glabrous, bright green, midrib and veins paler, prominent; outer involucre bracts variable, in most heads quite typical, but in some heads the longest more than 2 mm long, oblong, obtuse. Otherwise the heads and florets appear to be typical. But in one partly mature head all the achenes appear to be sterile. The pollen is very irregular and smaller than typical (17 to 25  $\mu$ ). This plant may be a hybrid between *japonica* and some other species. *Lin Pi 6331* (UC 308337), Hinghwa and vicinity, Fukien, China.

## RELATIONSHIP

The two subspecies *longiflora* and *Elstonii* seem without question to have been derived from *genuina*. But their genetic relationships, like their chromosome numbers, are at present unknown. They may be polyploids or they may have arisen entirely through gene mutations. Some specimens of *longiflora* were found to have irregular pollen-grains, but in both subspecies size of pollen-grains and size of stomata are the same as in *genuina*. Certain specimens with irregular pollen-grains may be hybrids between two of the subspecies, or the irregularity might be due to a gene for asynapsis.

*Y. japonica* is most closely related to *Y. heterophylla* and *Y. Rosthornii*, but is very distinct from them in leaf and floral characters.

25. *Youngia rubida* sp. nov. (Fig. 30)

Herba annua, ramosa a basi, rami divaricati, cum 3–4 ramulis remotis, ramuli cymosi cum 4–7 capitulis; folia lyrata vel integra, acuminata vel linearia, pubescentia; capitula parva, 13–15-flora; involucre et receptaculum glabratum; corolla 9–10 mm longa, aurea; antheræ circa 3 mm longæ, virides; achænia rubra, valde sed breviter rostrata, paululum compressa, cum costis inæqualibus; pappus albus, involucre æquali, persistens vel deciduus.

Annual, about 20 cm high; root slender; caudex 1 mm long, 3 mm wide, leafy; caudical leaves up to 9 cm long, 3.5 cm wide, oblanceolate, lyrate pinnately divided, terminal segment narrow, triangular, acu-

minate, acutely 2-lobed at the truncate base, lateral segments in 2 pairs, upper pair longer, all segments sinuate-denticulate, pubescent on both sides with many-celled piliform trichomes, these longer and broader on lower face especially along veins and petiole; lower and middle cauline

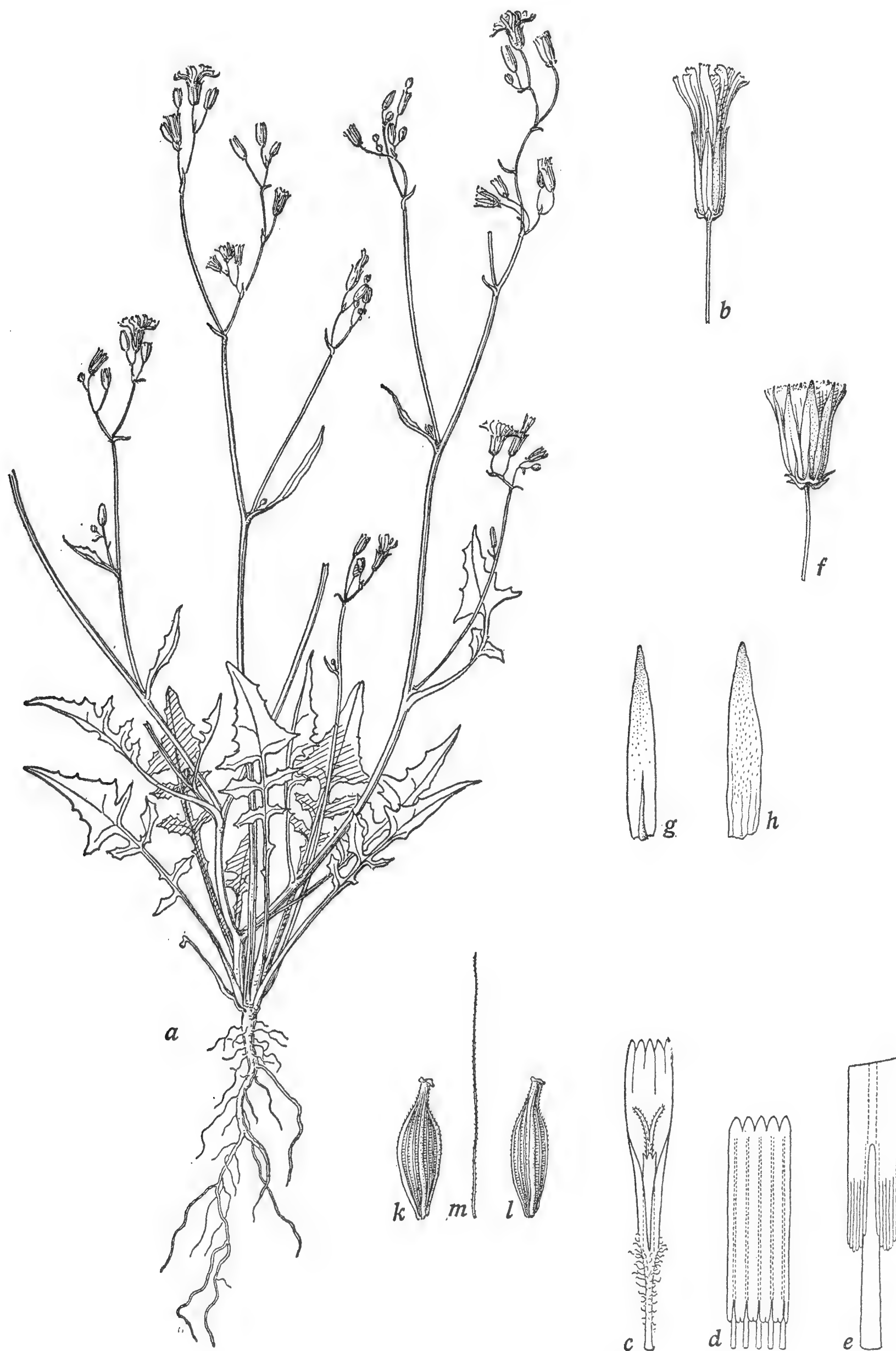


FIG. 30—*Youngia rubida*, from type (UC 482454): *a*, plant,  $\times \frac{1}{2}$ ; *b*, flowering head,  $\times 2$ ; *c*, floret lacking ovary,  $\times 4$ ; *d*, anther-tube,  $\times 8$ ; *e*, detail of appendages,  $\times 32$ ; *f*, fruiting head,  $\times 2$ ; *g*, *h*, two inner involucre bracts, dorsal and ventral,  $\times 4$ ; *k*, *l*, *m*, marginal and inner achenes and a pappus-bristle,  $\times 8$ .

leaves similar to caudical, gradually reduced, upper cauline leaves linear or 2-lobed near base, short-petioled, uppermost bractlike, minute; stem short, divaricately 4-branched from near base, branches elongate, remotely 3-branched, secondary branches strict or arcuate, cymosely 4- to 7-headed, pubescent below especially at nodes with many-celled piliform trichomes, glabrescent or glabrous on upper parts; peduncles 5 to 10 mm long, slender, glabrous; heads erect, small, 13- to 15-flowered; involucre glabrous, 6.5 mm long, cylindric (2 mm wide) in anthesis, campanulate (about 3 mm wide) in fruit; outer involucral bracts 5, ovate, acute, about 0.5 mm long; inner bracts 7, lanceolate, acute, membranous-margined, appressed-pubescent on inner face with short shining hairs, mediodorsally nerved, becoming carinate, pale, spongy-thickened confluent with base; receptacle areolate, naked; corolla 9 to 10 mm long; ligule 1.5 mm wide; teeth 0.2 to 0.3 mm long, slightly gland-crested and hooded; corolla-tube 3 mm long, densely pubescent with very short papilliform hairs at base, these gradually transformed into tortuous pointed hairs up to 0.4 mm long at summit and on base of ligule; anther-tube  $2.8 \times 1$  mm dis.; filaments extend beyond appendages about 0.4 mm; appendages 0.4 mm long, oblong, obtuse, united; style-branches 1.3 mm long, 0.1 mm wide, acute at tip, yellow; achenes dull scarlet (Ridgeway 5i, "Brazil red"), 2 mm long, 0.6 to 0.7 mm wide, marginal dorsoventrally subcompressed, inner 3- to 4-angled, strongly attenuate upward into a beak 0.3 to 0.4 mm long, 0.1 to 0.15 mm wide at summit, with slightly expanded pappus-disk, less attenuate downward, constricted at the hollow lightly calloused base 0.15 to 0.25 mm wide, 12- to 14-ribbed, ribs unequal, 4 to 5 stronger, all  $\pm$  salient, rounded at margin, obscurely spiculate from base to summit with extremely fine yellow spicules; pappus white, 3.5 mm long, 1-seriate, fine, soft, united at very base, coming away singly or in clumps, probably deciduous. Flowering October to November; flowers golden yellow, anthers green, style yellow; leaves pale yellowish green. Vernacular name, "*hwang-hwa*," "the yellow flower." Said to be used generally in the region as fodder for pigs.

Known only from the type locality. Collected November 6, 1930.

CHINA: Kweichow Province, Tsen-heng-hsien, Pumei, open waste places, 600 m alt., *Tsiang* 9254 (UC 482454) *type*.

#### RELATIONSHIP

Closest to *Y. erythrocarpa* but very distinct in its habit, larger heads, longer florets, broader achenes with stronger ribs, longer and more persistent pappus. Although the achenes are so similar in color to those of *erythrocarpa*, yet they are almost scarlet, whereas those of *erythrocarpa* are nearer to vermilion. For comparison of the two species with *Y. japonica* see *Y. erythrocarpa*.

#### 26. *Youngia erythrocarpa* (Vaniot) comb. nov. (Pl. 5; fig. 31)

Annual (or biennial?), 28 to 30 cm high, about 18 cm spread; root very slender, vertical; caudex 5 to 20 mm long, 3.5 to 7 mm wide, brown with bases of old leaves; caudical leaves up to 6 cm long, 3 cm wide,

lyrately pinnately divided, terminal segment acute or acuminate, triangular, truncate, dentate or obscurely lobed, lateral segments of 2 or 3 unequal pairs, upper pair much larger, elliptic or oblong, constricted at base, all segments remotely denticulate, sparsely pubescent with many-celled piliform trichomes pale and crinkled *in sic.*, petiole  $\frac{1}{4}$  to  $\frac{1}{3}$  as long as whole leaf, narrowly winged, broader at base; cauline leaves

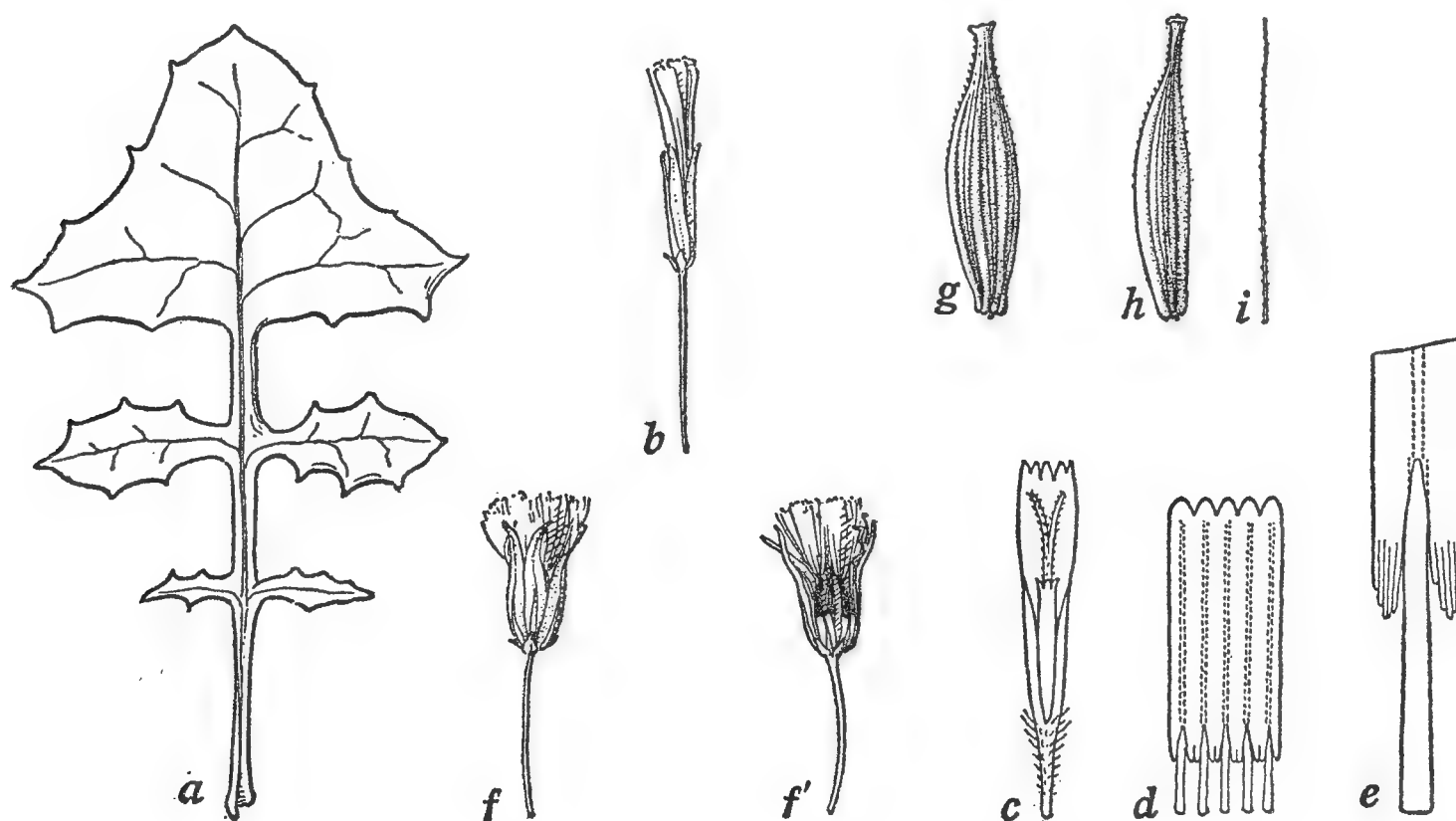


FIG. 31—*Youngia erythrocarpa*, from *Tang and Hsiu 203* (B) compared with type: *a*, cauline leaf, somewhat reconstructed,  $\times 1$ ; *b*, flowering head,  $\times 2$ ; *c*, floret lacking ovary,  $\times 4$ ; *d*, anther-tube,  $\times 8$ ; *e*, detail of appendages,  $\times 32$ ; *f*, *f'*, fruiting head,  $\times 2$ ; *g*, *h*, *i*, marginal and inner achenes and a pappus-bristle,  $\times 8$ .

similar or entire, lanceolate, acuminate, or bractlike; stem erect, slender, terete, not fistulose, about 14-branched, branches closely and nearly regularly spaced from near base upward, or with several equally strong ones from the base, strictly ascending, all or the upper 4 or 5 branches exceeding axis, sparsely pubescent or glabrous, bearing many filiform few-headed branchlets from near base to summit; heads erect, very small, 10- to 13-flowered; peduncles extremely fine, 2 to 25 mm long, glabrous; involucre cylindric, 4 to 6 mm long, 1 mm wide in anthesis, campanulate, 2 mm wide in fruit, glabrous; outer involucre bracts 5, lanc-linear, acuminate, 0.5 to 1 mm long; inner bracts 6 to 8, lanceolate, acute, membranous-margined, ventrally appressed-pubescent with short white hairs, dorsally glabrous, becoming carinate, pale spongy-thickened confluent with base; receptacle areolate, naked; corolla 6 to 6.5 mm long; ligule about 1 mm wide; teeth 0.1 to 0.3 mm long, glanduliferous at tip, slightly hooded; corolla-tube 1.5 to 2 mm long, densely pubescent with acicular hairs up to 0.25 mm long; anther-tube  $2.2 \times 0.8$  mm dis.; filaments extend beyond appendages 0.4 to 0.6 mm; appendages 0.3 to 0.4 mm long, lanceolate, acute, united; style-branches 0.9 mm long, 0.1 mm wide, linear, acute, yellow; achenes dull yellowish red (Ridgeway 7i, "English red"), 2.25 to 2.5 mm long, 0.5 to 0.6 mm wide, marginal dorsoventrally compressed, inner subterete or angular, strongly attenuate upward into a coarse beak 0.2 to 0.4 mm long and 0.12 to 0.15 mm wide, with slightly expanded white pappus-disk 0.2 mm wide, attenuate to the narrow (0.2 to 0.25 mm wide) hollow lightly calloused base, 11- to 14-ribbed, ribs unequal, 3 to 5 much stronger especially the



lateral ones in marginal achenes, smooth or obscurely spiculate toward summit, spicules extremely fine, yellow; pappus white, 2.5 to 2.75 mm long, 1-seriate, fine, soft, caducous. Flowering June to July; flowers yellow, anther-tube green, style yellow. (*Lactuca erythrocarpa* Vaniot, in Bull. Acad. Geogr. Bot. 12:319, 1903.)

CHINA: Kouy-Tcheou (Kweichow) Province, Kouy-yang (Kwei-yang), among rocks east of garden wall, *Bodinier* 2621 (E), as *Lactuca erythrocarpa* sp. n. = *type*; Chekiang Province, Hangchow, *Tang and Hsiu* 203 (B).

The two specimens agree in every detail, except for the following: the type has a thicker caudex, which suggests that it may have behaved as a biennial, whereas the other specimen is certainly an annual; the type has four strong branches arising from the base, but on the other the first branch is 5 cm above the base; the stem and branches are sparsely pubescent in the type and glabrous in the other; the achenes are perceptibly richer in color in the type and have somewhat stronger ribs. These differences in the achenes are explained by the fact that the achenes from the type are fully mature, while those from the other plant are not. None of the other differences are of much significance. Even the biennial and annual habit are known to occur in several species of *Crepis*. In such species the duration of the life cycle is probably conditioned by time of seed germination, a seed germinating in late summer or autumn producing a plant which winters over in the rosette stage, and a seed germinating in the spring producing a plant which matures the same season.

Regarding the identity of the type locality, we cite *Index Kewensis*, in which Kouy-Tcheou is identified as Kweichow. It is probable that this species is distributed throughout the region between Kweichow and Chekiang. The provinces of Hunan and Kiangsi have been little explored botanically.

#### RELATIONSHIP

Closest to *Y. rubida* but very distinct in its habit, smaller heads, shorter florets, narrower achenes, and shorter, caducous pappus.

Both *erythrocarpa* and *rubida* differ from *Y. japonica* in the shortly beaked, light-red, obscurely spiculate achenes and the caducous or deciduous pappus; the corolla-tube is more conspicuously pubescent, the style-branches are longer, and the anther-appendages wider; furthermore, the habit of the plant in both species differs from any form of *japonica* and the leaves differ in size and form.

Although this species was first described under *Lactuca* sect. *Ixeris*, the achenes are not typical of *Ixeris*, since they have more than ten ribs and the ribs are very unequal as in other species of *Youngia*.

#### SPECIES INCERTÆ SEDIS

27. *Youngia silhetensis* (DC.) comb. nov. (*Hieracium silhetense* DC., Prod. 7:218, 1838; *Crepis silhetensis* Hook. f., Fl. Brit. Ind. 3:397, 1882.)

The achenes of this species are unequally ribbed, slightly compressed, and attenuate at the summit. It would, on the basis of this criterion,



*Youngia erythrocarpa*, type (E)



be classified in *Youngia* rather than in *Hieracium* or *Crepis*, although in the character of both its involucral bracts and its pappus it is most like *Hieracium*. In its habit, however, it resembles some species of *Ixeris*, such as *I. laevigata* (Blume) Stebbins, more closely than any species of the three genera mentioned above. It is apparently a transitional species, whose complex relationships will be discussed in a later publication, after more material of it and its relatives has been examined.

*Hieracium glumaceum* E. R. Fr. was reduced to this species by Zahn (cf. Engler, Pflanzenreich IV(280):1081, 1922). From a photograph of the type specimen of *H. glumaceum* in Herb. Upsala, for which we are indebted to Professor N. E. Svedelius, it appears that this plant is neither *Hieracium* nor any genus of the Cichorieæ. Very probably it is a species of *Ainsliea* (cf. *A. glumacea* Sch. Bip., in Pollichia 20-21:407, 1863).

## SPECIES EXCLUSÆ

(NOTE—The following list is based on *Index Kewensis*, and on comparison of published descriptions and of such specimens as have been available. Where type material representing the synonym has been seen, the reference is marked with an !.)

- Youngia acaulis* DC., Prod. 7:193 = *Launæa acaulis* (Roxb.) Babcock, ex Craib in Flora Siam. Enum. 2:299, 1936.  
*Y. affinis* Zoll. et Mor., in Nat. en Geneesk. Arch. Néerl. Indie 2:256 = *Lactuca rostrata* (Blume) Boerl.  
*Y. aspera* Steud., Nom. ed. II, 2:393 in syn. = *Chondrilla aspera* Poir.  
*Y. chinensis* DC., Prod. 7:194 = *Ixeris chinensis* (Thunb.) Nakai.  
*Y. chrysantha* Maxim., Prim. Fl. Amur 181 = *Ixeris denticulata* (Houtt.) Stebbins.  
*Y. debilis* DC., loc. cit. = *Ixeris japonica* (Burm.) Nakai.  
*Y. dentata* DC., Prod. 7:193 excl. syn. = *Ixeris denticulata*.  
*Y. elegans* Rydb., Fl. Rocky Mts. 1021 = *Crepis elegans* Hook.!  
*Y. flexuosa* Ledeb., Fl. Ross. 2:838 = *Crepis flexuosa* (DC.) Benth. et Hook. f.  
*Y. glauca* Edgew., in Trans. Linn. Soc. 20:79 = *Crepis flexuosa*!  
*Y. gracilis* Miq., in Jour. Bot. Néerl. 1:106 = *Ixeris?* ex descr.  
*Y. hastata* DC., Prod. 7:194 = *Ixeris denticulata*.  
*Y. humilis* DC., ibid. = *Lapsana humilis* (Thunb.) Makino.  
*Y. humilis* Miq., loc. cit. = *Ixeris chinensis* (Thunb.) Nakai? ex descr.  
*Y. integra* A. Gray, in Mem. Am. Acad. Sci. n.s. 6:396 = *Ixeris lanceolata* (Houtt.) Stebbins.  
*Y. Kochiana* Ledeb., Fl. Ross. 2:837 = *Crepis pulchra* L.  
*Y. lanceolata* DC., Prod. 7:193 = *Ixeris lanceolata*.  
*Y. nana* Rydb., loc. cit. = *Crepis nana* Richards.!  
*Y. procumbens* DC., loc. cit. = *Launæa nudicaulis* (L.) Hook. f.  
*Y. pygmæa* Ledeb., Fl. Ross. 2:838 = *Crepis nana*!  
*Y. serotina* Maxim., Prim. Fl. Amur 180 = *Ixeris denticulata*.  
*Y. sonchifolia* Maxim., ibid. = *Ixeris denticulata* subsp. *sonchifolia* (Bunge) Stebbins.



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The genus *Youngia*,